

Aviation Week & Space Technology

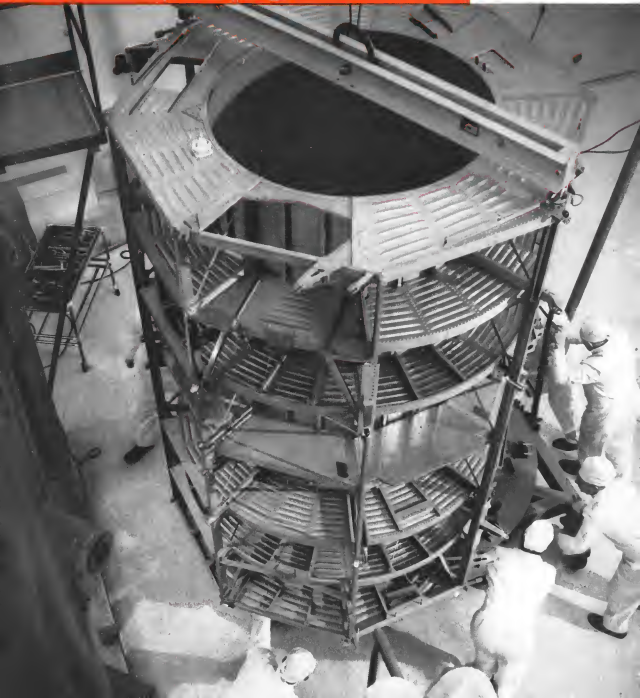
June 18, 1962

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AEROSPACE CALENDAR

- (Continued from page 5)
- Aug. Rocket Society, Ted Carter and Bob in Helina Hotel, Cleveland, Ohio
 - July 24-Aug. 1—National Spring Championships, 17 Motor Club, For information: National Spring Championships, P. O. Box 997, Victoria, Calif.
 - Aug. 15—Exposition, Aircraft, Los Angeles, California, Exposition, Exhibition 30
 - Aug. 16—Los Angeles World Conference, Los Angeles Convention Center, Los Angeles, California
 - Aug. 17—Los Angeles World Conference, Los Angeles Convention Center, Los Angeles, California
 - Aug. 18—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 19—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 20—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 21—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 22—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
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 - Aug. 24—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 25—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 26—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 27—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 28—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 29—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 30—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado
 - Aug. 31—1962 Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado

HEAT EXCHANGERS IN A HURRY



(Or: A new slant on $q = U A (t_1 - t_2)$)

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AEROSPACE CALENDAR

(Continued from page 7)

- Aug. 25-Sept. 1—Second International Congress International Federation of Aeronautics Engineering Societies, Munich, Germany.
- Aug. 28-30—Fourth Conference on Maintainability of Electronic Equipment, Electronic Industries Assn. (in conjunction with Department of Defense), University of California, Boulder, Colo.
- Sept. 5-7—Naval Aircrew Technology Management Conference, Institute of Naval Engineers, Seattle, Wash.
- Sept. 9-7—International Symposium on Inertial Theory, Institute of Radio Engineers, Brussels, Belgium.
- Sept. 13-15—1962 Flight Display and Exhibition Society of British Aircraft Constructors, Farnborough, England.
- Sept. 17—Symposium on Measurement of Thermal Radiation Properties of Solids, Defense Research Agency, Dayton, Ohio.
- Sept. 17-19—Sixth Annual Meeting of the National Bureau of Standards, NBSA, National Bureau of Standards, NBSA.
- Sept. 18-19—Fourth National Conference on Applied Meteorology, American Meteorological Society, Houston, Tex.
- Sept. 18-19—Annual General Meeting, International Air Transport Assn. (IATA), Sept. 13-14—1962 Annual Engineering Management Conference, IBE, Hotel New York, New Orleans, La.
- Sept. 17-18—Industrial & Air Confusion VIII, Radio Meeting, Institute of the Aerospace Sciences, Washington, D.C., Washington.
- Sept. 18-21—10th National Conference & Aerospace Progress, Air Force Assn., Las Vegas, Nev.
- Sept. 20-22—Technical Symposium Urban and Marine, Institute of the Aerospace Sciences, El Paso Conference, New York.
- Sept. 20-22—Symposium & Management Symposium, Aircraft Corp., Malvern, N.Y.
- Sept. 20-22—Second International Agricultural Aviation Congress, National Superior Agriculture School, Gers, France.
- Sept. 24-25—1962 International Astronautical Congress, American Rocket Society, Seattle, Chicago.
- Sept. 25-26—Faster Systems Conference, American Rocket Society, Western Head Santa Monica, Calif.
- Sept. 26-Oct. 2—1962 General Conference Federation Aeronautique Internationale, Mexico, Mexico.
- Sept. 28-29—Society of Experimental Test Pilots, Sixth Annual Aircraft Design & Research, Denver Hilton Hotel, Boulder, Colo.
- Oct. 1-3—International Symposium on Space Platforms and Missions in the fields of Radio Engineers, Santa Elena Hotel, Detroit, Mich.
- Oct. 2-3—Symposium on Dynamics of Moving Liquid Planetary Entry, Philadelphia, Pa. (Sponsored by the American Society of Mechanical Engineers, Room M713A, General Electric Co., Natick, Mass., Valley Forge Space Technology Center, Box 1015, Philadelphia 15).
- Oct. 13-14—Cosmos AFOSR.
- Nov. 13-15—1962 Annual Meeting and Space Flight Exposition, American Rocket Society, Los Angeles, California, Los Angeles, Calif.

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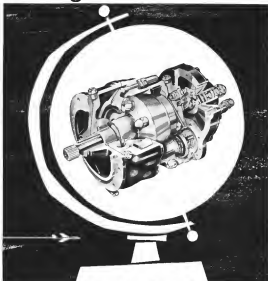
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June 16, 1962

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TECHNICAL EDITOR: David A. Anderson
CONTRIBUTING EDITOR: David Anderson
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COVER: Illustration and technical drawing of a model of a new aircraft, showing the engine, the fuselage, the wings, the tail, the landing gear, the cockpit, the cabin, the cargo hold, the fuel tank, the oil tank, the water tank, the air tank, the oxygen tank, the nitrogen tank, the hydrogen tank, the helium tank, the neon tank, the argon tank, the krypton tank, the xenon tank, the cesium tank, the barium tank, the strontium tank, the calcium tank, the magnesium tank, the sodium tank, the potassium tank, the rubidium tank, the francium tank, the actinium tank, the thorium tank, the uranium tank, the plutonium tank, the americium tank, the curium tank, the berkelium tank, the californium tank, the einsteinium tank, the fermium tank, the mendelevium tank, the nobelium tank, the lawrencium tank, the rutherfordium tank, the dubnium tank, the seaborgium tank, the bohrium tank, the hassium tank, the meitnerium tank, the darmstadtium tank, the roentgenium tank, the copernicium tank, the nihonium tank, the flerovium tank, the livermorium tank, the tennessine tank, the oganesson tank.

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EDITORIAL

New Horizons for Aircraft

With the dawn of the space age and the accompanying rise of the intercontinental ballistic missile as an operational weapon, there has been a tendency in some military, industrial and technical circles to abandon development of the aircraft as a useful vehicle. In the natural and necessary rush to transfer new space technology from government, both industrial and governmental, have come dangerously close to forsaking the aeronautical technology that is still an important foundation for spaceheads into space as well as a fruitful source of new applications to man's age-old problem of transportation.

For a while it looked to many observers of the aerospace industry as if the B-70 program might represent the last dying gasp of aircraft as military weapons and the supersonic transport program might be their last useful application in the civil field. We never subscribed to this viewpoint. For the past several years we joined ardently those voices who warned against abandoning all research and development effort in the aeronautical field.

Thus it is happening now to see many signs of the pendulum swinging back to a more realistic balance on the future of new types of aircraft along a wide range of performance capabilities.

An aircraft is simply a transportation vehicle whether it carries weapons, people or cargo. The advantages its applications offer come in the complexion of time and the resulting increase in mobility, although more sophisticated studies of the overall transport problem now indicate that reduced cost is becoming an important competitive factor in long air transport over ocean methods.

Although the ICBM has become the prime delivery method for nuclear warheads, and space-to-earth systems may take over some of the aircraft's traditional long range reconnaissance missions, a wide variety of new aircraft types and applications is developing, from the variable geometry F-15 tactical fighter concept and VTOL attack and transport aircraft down the technical spectrum to ultra-simplified general aviation aircraft. While strategic delivery capability will remain the prime measure of military power, it is obvious that the lack of an effective land and sea capability, arising from suppression of guerrilla infiltration in Korea-type non-nuclear conflicts, would severely handicap the exercise of national will in the international scene.

In the current effort to increase U.S. capability in this area, heavy reliance must necessarily be placed on aircraft and helicopters already in the inventory, many of them from unutilized stockpiles. But as the urgency of this requirement increases, and opposing forces' responses to it increase, as indeed they both will, it will be necessary to develop a whole family of new aircraft applying all of the new technology now available to solve these limited war problems. These requirements will not only affect the military and engine manufacturers but will also develop

a new market for all of the secondary equipment, including avionics, that must be adapted to these new tasks. Aircraft and helicopters are still the only transportation methods that can deliver heavy firepower, troops and supplies with the mobility required for non-nuclear war. The flying crane concept, as typified by the Sikorski S-64 and the Mil Mi-6, should also fit into the picture.

In the transport field it is now obvious that aeronautical development has a great deal to contribute in addition to the supersonic transport. The supersonic transport program is certainly a spearhead of advances for the whole aeronautical state of the art, but it is by no means the whole story for development of better air transport.

The jet executive-type transports of Lockheed, Aero Commander, Lear, and de Havilland, to name a few, are already on the technical scene, and their widespread availability will certainly mean a major change in the character of the business flying fleet. The short-haul jet transport field has become a highly competitive battle between the Boeing 727, de Havilland Trident, British Aircraft Corp's BAC 111 and advanced Caravelles.

The climate is growing for a medium gross weight turbofan aircraft capable of filling the gap in the air transport network between the bulk and small cities and the traffic hubs of the short-haul carriers. Closely related to this requirement is the development of modern aircraft specifically designed to open up economically countries that are now hemmed to primitive transportation systems lacking even adequate road networks. The use of air vehicles for fire missions has already been demonstrated in the mining and oil exploration around the world, but there has never been the political link to apply this technology to the foreign aid program. Instead, vast sums have been poured into far less productive forms of transport for these backward areas.

It has also become clear that the Soviet Union is fully aware of the political opportunities offered by access through initial technical penetration with civil aviation. Neither the U.S. government nor the aerospace industry has been particularly responsive in responding to this threat although this country possesses superior resources.

The requirement for development of a new generation of air vehicles across the entire technical spectrum now is emerging. It will require not only some strong industry stimulation but also a more perceptive approach by national policy makers if this great national resource of aeronautical capability is to be usefully applied in the space age. Both technicians and policy makers will have to apply a high degree of originality as well as ingenuity to make this new generation of aircraft serve the military, economic and social environment of the future in which they must operate successfully.

—Robert Hutz

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WHO'S WHERE

In the Front Office

Gen. Louis D. Clay (USA, ret.) elected to the Board of Trustees of Aerospace Corp., Los Angeles, Calif.

William E. Rouse, president, Lockheed Aircraft International, Inc., Los Angeles, Calif., attending J. Kenneth Hall, acting

Douglas Serna, California businessman, closed a divorce in National Airlines, Inc.

Richard N. Gelbach, vice president, Lennor and a divorce, Southern Instruments, Inc., Los Angeles, Calif.

Wm. C. C. Shuman (USA, ret.) assistant to the president of Standard Research Institute, Menlo Park, Calif.

W. E. Strick, vice president, Aerospace, Inc., South El Monte, Calif., a subsidiary of Aero-Space Corp. Paul R. Allen, vice president and director of market

and Aerospace Corporation, Inc., Culbert City, Calif., a division of Aerospace.

The Science Corp., Berkeley, Calif., has been transferred and the following appointments announced: Vice President George E. Wynn, general manager of the newly formed Science Division

Wm. Frederick C. Gilbert, general manager of the Strategic Division, formerly Science Electronics, Vice President S. F. Allen, continues in general manager of the firm

and Division. Also, George E. Wynn, corporate director of technical staff.

Dr. Richard B. Marston, director, Research Institute and President, Pacific Office of Space Sciences, National Aerospace and Space Administration, Wash-

ington, D.C., and Dr. John R. Clark, in general director and chief scientist.

Dr. John R. Naughton, Dr. Clark in director of Contract and Aerospace Programs. Dr. Marston succeeds Dr. Donald H. Baker.

USAF was transferred to the Air Force Systems Command. Also, William H. Evans, director, NASA's Pacific Launch Division, Office, Fort Belvoir, Calif.

Joe L. Bowering, technical director, U.S. Naval Propellant Plant, Indian Head, Md.

Honors and Elections

Joseph A. Walker, chief research pilot for the National Aeronautics and Space Administration, Flight Research Center, has received the National Medal of Science.

Dr. E. T. Jones, vice president, Lockheed, General Dynamics Aerospace, has received the Order of the Navy for his many years of his contribution to the Department of Defense activities in the area of aerospace and product support.

Dr. S. Bowering, a director and chief engineer of British Aerospace America, has taken office as the president of the Royal Aeronautical Society, Inc. (1967-68), succeeding Air Marshal Sir Owen Jones.

Carl A. Resnik, vice president, operations of Lockheed, has been elected president of the Air Transport Association Operations Conference and J. E. Dwyer, vice president, general transport, has been elected president of the Air Transport Association.

(Continued on page 186)

INDUSTRY OBSERVER

Defense Secretary McNamara has authorized initial planning for a contract to develop and control system, designed to provide the President and Joint Chiefs of Staff with accurate information for control of U. S. global forces. Responsibility for the new program has been given to the Global Communications Agency, working under the Joint Chiefs of Staff.

Positive USAF plans for production of the United Technology Corp. 120-in. supercritical solid propellant rocket motor (AW May 14, p. 15) will be government at a rate of approximately eight units per month and may require UTC to start production at a rate as high as four million pounds per month. Total market is expected to reach about \$1.5 billion by 1975.

Industry proposals are being received for competition to equip the third and fourth steps in the Mobile Airborne Range System (MARS) system (AW June 12, p. 181). Proposals were requested earlier this month by Air Force Missile Test Center of Patrick AFB, Fla.

Scheduled launch date for Bell System's Teletext communications satellite has slipped from late August to mid-July because of delay in satellite availability. However, Defense Department officials who recently visited Bell Telephone Laboratories to see Teletext, in connection with study and subsequent reconfiguration of the Advent satellite program (see p. 12), came away highly impressed with the quality of the BTL effort.

Tactical Air Command is sending Air Force bases and sending letters to qualified reserve officers to obtain pilots for a backup of fighter squadrons. Air Force of Air National Guard forces from active duty will replace TAC to build up forces to complement the Strategic Air Corps (STRAC) under the continued Air Force strike command. Reserve officer pilots are being recalled to reserve duty for STRAC/TAC assignments to fill outposts recruited for the first time since 1957.

USAF headquarters has begun selective release of study contracts for long-range weapons systems requirements that are part of the Strategic Air Corps program. The program was halted a year ago on the ground that too much engineering time and money was devoted to the study in industry (AW May 14, p. 20), but six such programs were released in May.

U. S. sends ground stations for electronics field probes in the joint U. S.-Soviet Union research program (AW June 11, p. 39) to be located in India or Brazil, according to Roy James G. (R. J.), second in command, Republic of the Electric Science and Astronautics Committee. Fisher said the Soviet Union is now looking for the system in India.

System which will be used in USAF Systems Command Space Systems Division-Astronautics Committee (VIA) satellite program for detection of nuclear missile in space are expected to be sufficiently sensitive to detect, from a 10,000-mi. diameter earth orbit, nuclear explosions in far more in the vicinity of Miss.

Triangular-shaped satellites, proposed to be created piggy-back on Atlas early warning or Soviet surveillance satellite boost vehicles, are being developed by Space Technology Laboratories for measuring damage to solar cells in the Via Astra solution belt. Program will involve development of one prototype satellite for ground calibration and as for orbital operations.

Astronautics is working along with its new battlefield satellite constellation, tentatively called Mobile Air Force Guidance Missile Command, Redstone Arsenal, Huntsville, Ala., has invited industry to submit capability statements.

Ann of Navy's Transit satellite navigation system, when it becomes operational next year, is to have four in orbit of the vehicles in polar orbits providing continuous coverage in polar areas. These will be "backbone" or more temporarily not covered by the satellites in the lower orbits. These may be covered by satellites in 24-hr. synchronous equatorial orbits.



LOOKING FOR CANDIDATES TO FILL A KEY POSITION We strive to fill our key positions from within. To find candidates we search the broad spectrum of our staff's capabilities and interests which are stored in a Bendix G-20 computer. This Bendix Skills Inventory System is one of the most advanced in use, and is correlated with our project plans and requirements. If you are an engineer or scientist in the space technologies, and would like to see your experience and interests entered in this system for employee recognition and opportunity, please contact our Personnel Director, Bendix Systems Division, Ann Arbor, Michigan—an equal opportunity employer.

Bendix Systems Division



**WHERE IDEAS
UNLOCK
THE FUTURE**

Washington Roundup

AMR Custody Dispute

National Aeronautics and Space Administration has won a behind-the-scenes battle with the Air Force for custody of the space agency's holdings at the Air Force Missile Range, with an assist from Chairman George Miller of the House space committee.

Air Force campaign went as far as to push for an executive order to give the service control over the 72,644-acre area NASA is acquiring at Cape Canaveral (AW Feb. 12, p. 12). But this effort was defeated when Rep. Miller's committee added language to NASA's budget authorization bill specifying that the space agency would have custody over any land it acquires.

Deputy Defense Secretary Russell Galpin met with Rep. Miller and NASA Administrator James Webb at a private luncheon in the Capitol and tried to persuade them to renounce the restriction. But Rep. Miller stood firm. He feels the Air Force does not need custody of the land to manage the range efficiently.

Air Force also wanted to buy 14,800 acres for Titan 3 facilities at the Cape north of NASA's new tract. But NASA won. While House approval to make the acquisition, Webb last week, asked the Senate space committee (see p. 27) to authorize \$12 million for this additional acreage, including the cost of relocating the Thunderbolt Canal and bridge, part of the intercoastal waterway.

Nuclear Test Spying

U.S. is now trying to jam sensors on the Russian ships standing outside the nuclear testing area in the Pacific. Defense leaders hope the Soviet government will acquiesce when U.S. ships try to observe the expected new round of Russian tests in the Arctic. Also, it is difficult to gain the type of electronic equipment the Russians are using. Soviets are especially interested in the electromagnetic signatures of the nuclear blast.

Cuban air force now includes 68 Russian-built MiG-type jet fighters, including 18 supersonic transport MiG-19s. Cuba has also received from Russia 24 MiG-4 helicopters, 50 An-2 utility planes and 5 B-14 twin-engine transports.

American medical report is expected soon on USAF Maj. Donald Skyles, the astronaut dispatched from Mercury flights because of heart flutter. Dr. Paul Dudley White, heart specialist, has entered the case. One of NASA Administrator Webb's big worries is the danger that would be posed if Skyles's heart began fluttering just before lift-off.

House Airlift Probe

House Armed Services special subcommittee will review U.S. tactical and strategic airlift capability in a series of hearings starting late next month in early August.

Chairman (Mondel) Keren, in reviewing airlift capability, also will take testimony on a bill to give the President authority to take over any transportation system during a national emergency and a measure to reorganize the Military Air Transport Service as the Military Airlift Command and place it under the Joint Chiefs of Staff. NAVT's reorganization was recommended by the subcommittee after its extensive 1950 hearings.

President Kennedy will make the first live nationwide televised on communication satellite when the Bell System's Telstar goes into orbit—hopefully this summer. Edward R. Murrow, U.S. Information Agency director, is drafting the 10-min. telecast in concert with a commentary followed by discussion TV network. Telecast may include play for communication satellite stock to be sold to the public (see p. 12).

Supplemental Airlines

Bank is anticipated in the dispute between the House and Senate conferees on widely different bills giving permanent operating authority to supplemental airlines. House bill now has passed the limited individual routing authority, as its bill to confirm more closely with the more liberal Senate version. But House conferees finally are taking seriously about having this authority on a fixed percentage of port business.

Dr. Harold Brown, director of Defense Research and Engineering, estimates new F411A (TFX) will cost about \$1 million while an RS-70 would cost about \$100 million if a wing of 45 aircraft were built. He gave these estimates during a closed meeting of the Senate Appropriations Defense Subcommittee.

Capitol corridor comment after Sen. John McClellan's hearing on providing defense profits: "An elephant in a mouse developed under a cost-plus-fixed-fee contract."
—Washington Staff

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PHOTO 1 (Left) **PHOTOGRAPH** shows the motor being hoisted into a large test pit at Aerojet-General's plant in Azusa, Calif. (Right) **PHOTOGRAPH** shows the motor being hoisted into a large test pit at Aerojet-General's plant in Azusa, Calif. (Right) **PHOTOGRAPH** shows the motor being hoisted into a large test pit at Aerojet-General's plant in Azusa, Calif.

Nozzle Failure Halts Solid Rocket Test

PHOTO 2 (Left) **PHOTOGRAPH** shows the motor being hoisted into a large test pit at Aerojet-General's plant in Azusa, Calif. (Right) **PHOTOGRAPH** shows the motor being hoisted into a large test pit at Aerojet-General's plant in Azusa, Calif.

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Aerojet-General Photograph



Missiles and Rockets Photograph

"Highly successful test . . . work on big solids is continuing."

AEROJET-GENERAL CORP. released the following press announcement on the June 9 firing of its augmented solid rocket: "A new American thrust level of 700,000 lbs. for solid-propellant rockets was set here today under a U.S. Air Force program. The highly successful test was marred when the intense heat called for caused a burn-through in the rocket casing, allowing gas to escape. The rocket did not explode, nor did its parts scatter. Instead, the escaping gas continued to burn through the aft-section until the 139 tons of propellant was consumed. Richard

D. Geckler, Aerojet-General Corp. vice president and manager of the firm's Solid Rocket Plant, said 'The overall success of the firing confirms our confidence in large solid rockets.' Air Force representatives who viewed the test expressed their satisfaction with the data obtained, relating to: a) Record thrust of over 700,000 lbs.; b) Successful ignition of the largest mass of propellant ever put together, and c) Significant information on steering large motors. Work on big solids by the company is continuing."

SYSTEM Awards

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Foes Hope to Amend Present Comsat Bill

Washington — Government ownership advocates plan to offer a long array of amendments to legislation establishing a privately-owned corporation to develop and operate a communications satellite system—*as expected, the Senate rejects their first proposal for a government corporation.*

The Senate this week or early next week will start consideration of the measure proposing the private corporation, which would be financed 95% by the federal public and 5% by communications satellite system (ASV Apr. 2, p. 28). It is sponsored by the Administration, passed the House 194 to 9, and was voted out of Senate Commerce Committee 15 to 2.

Some of the proposed amendments were proposed last week in the Commerce Committee majority report, signed by Sen. Ralph Yarborough (D-Texas) and Sen. E. L. Barker (D-Iowa).

They included:

- Minimum price of \$25 a share on the corporation's stock, instead of \$100, to encourage wide public distribution.
- A limitation of 10% in the amount of the common stock that could be owned by any single stockholder. The present intention provides for an equal distribution of the stock among the citizens, but plans no specific limitation on the amount that may be owned. It also limits ownership of the stock offered to the public sale to 10% of the one individual or affiliated group. The measure said that future regulations that the state limitation be applied to the entire stock.

- Requirement that ground stations be owned by the communication satellite corporation. The bill now leaves it to Federal Communications Commission discretion whether they are to be owned by communication common carriers, by a consortium of carriers, or by the satellite corporation. The majority said that if ownership is left to the carriers, "there will, in effect, have control of satellite communications. If the Federal statutes are amended, the carriers owned by the corporation, it may be possible to improve the competitive character of both domestic and international communications."

- "Strong language" guaranteeing small business a role in the satellite system "in view of the fact that the communications carrier will be more in revenue in the corporation are also in the manufacturing business, and since the non-competitive sale will be held by large corporations engaged in satellite leasing and supply."

- A prohibition against officers and directors of the satellite corporation having "any direct or indirect financial

connection with any communication carrier or equipment manufacturer, or member of the satellite corporation." The present legislation only bars officers from receiving salary from any other source during their period of employment by the satellite corporation. Communications Secretary, Warren E. Hearnes, and Barker declared in their dissenting report.

"Not only does the bill create a gross anomaly, it would go even farther and bestow on that single private

company the benefits of billions of dollars of the taxpayer's money. This legislation, if enacted, would undoubtedly be the biggest giveaway in the history of the United States."

"All the elements necessary for the very existence of an open and fair competitive market, in other words, are destroyed by all the taxpayers of the U.S. It is our belief that if these same taxpayers should receive the benefits of the system when it becomes operational."

USAF to Develop Two Satellites In Advert Program Reorientation

By Philip J. Khan

Washington—Air Force has been given responsibility for development of a new lightweight, medium-orbit communication satellite and a new medium-orbit, medium-orbit communication satellite. The Defense Department's decision to accept its Project Advert program (AW May 30, p. 25, June 11, p. 21).

The Advert, which had management responsibility for the Advert project since September, 1968, with development of launch vehicle and spacecraft delegated to the Air Force, now retains responsibility only for development and operation of the project and support elements. Portions of the ground environment need for launch and control of the satellite may be assigned to the Air Force, the Defense Department and Army, who will be responsible for developing ground terminals for the new medium-orbit satellite.

Separate Funding

The Defense Communications Agency, which operates a joint-service tactical communications network that would use the communication satellite, is given responsibility for the satellite system. The agency has face problems. The first and third agencies involved in the new program will be funded separately for its portion of the project, tentatively scheduled in August 2.

The decision to restrict the Advert program results from several factors, including delays in development of the Centaur vehicle, which was to put the 1,500 lb. satellite in an equatorial orbit at 22,100 mi., and problems involved in the division of Army and Air Force responsibilities. Satellite weight also had given to the point that the Air-Comsat capability was marginal for a 22,100 mi. orbit.

Defense is intent on expanding its global communications capabilities by means of satellites. Initially, by 1974-75, a recent study indicated that advances in stabilization techniques and lightweight covering were taken might permit the design of a lighter weight version of the original Advert satellite, about 500 lb., with little sacrifice in performance. Such a satellite could be launched by an Atlas-Agena B vehicle. Recognizing the present satellite workload in placing a satellite in synchronous equatorial orbit and keeping it there, Defense decided also to develop a medium-orbit communication satellite which might be operated several times a day, at altitudes of about 5,000 mi.

SSD Function

At AFOSI's Space Systems Division, Los Angeles, will handle USAF's new mission in the re-oriented program, and will call for industry proposals on the two types of satellite uses, perhaps within 60 days. First, program re-oriented may call for a program development phase in late with current Defense policies.

Defense hopes for cutting the weight of a synchronous satellite size from new lightweight involving new tubes, not available for use in the original Advert at the time the design was frozen. These tubes provide extremely broad-band performance and require no electrical power from conventional tanks, making the weight of spacecraft power supply. Such tubes, specifically designed for long life in the open environment, have been developed by Bell Telephone Laboratories, Radio Corp. of America, Wallace-Johnson and others. First train will come in the Telstar and Relay satellites, under development by American Telephone & Telegraph and RCA, scheduled to launch by the National Aeronautics and Space Administration

during the summer and fall of this year.

New techniques for stabilizing a satellite against rotation patterns instead of the entire vehicle, to orient the antenna toward the earth also offer possibilities for major savings in weight and complexity. One such technique, developed by Hughes Aircraft, will be used on its lightweight Sonacon communication satellite under development for NASA (AW June 11 p. 30).

Highly sensitive satellite systems on the NASA satellite program are both expected to lead the new satellite contractors.

Thus, a qualification that AT&T might enter a version of its own Telstar in the competition.

General Electric, whose marine and space vehicle department is building the original Advert spacecraft, will also manufacture and produce payload, also is expected to be a contractor, along with Bendis, which holds the prime contract for Advert spacecraft and ground-based communications equipment.

Proposals Submitted

In the mode of the Defense Department study on Advert, Hughes Aircraft, Space Technology Laboratories and General Electric reportedly have recently submitted preliminary proposals to the Space Systems Division for a lighter weight medium-orbit communication satellite, while Philips and RCA have proposed medium-orbit satellite designs.

Both GE and Bendis are expected to complete and deliver the first new Advert Advert prototype and possible the first flight model to the Air Force for test and evaluation, but further work has been halted. As a result, General Electric has lost of approximately 1,100 employees, including engineers at its mobile and space vehicle department—approximately 10% of the current employment.

B-52H Ends Category 2 Tests at Edwards AFB

Category 2 tests of the Boeing B-52H were completed at Edwards AFB, Calif., June 15. Four of the missions B-52Hs were used in the point Air Force Flight Test Center, Strategic Air Command tests involving 1,500 lb. in during the past year.

One of the 655-000 lb. bombers flew 1,500 lb. in missions of the complete weapon system, weather aircraft, and used for performance, stability, and control tests both with and without external stores of Skybolt and Hound Dog missiles. A third B-52H was used in advance satellite tests with the fourth used for mission system tests at Boeing, Wichita.

Leas-Siegler to Combine Divisions

Los Angeles—Leas-Siegler, Inc., the corporate entity, comprising four of the seven approved divisions of Leas-Siegler Corp., will strongly emphasize automatic and radio systems capabilities of the combined organization.

A large number of personnel and organizational changes from former corporate units are expected to be announced in coming weeks in the combined organization attempts to create an image of a major aerospace organization.

Among anticipated changes will be the formation of the following divisions or groups:

- **Aero-Structures Division**, El Segundo, Calif., formerly the Siegel-Hillford Division, which makes radio navigation aids for Minuteman ICBM first and second stages.

- **Electronic Instrumentation Division**, Anaheim, Calif., formerly the Siegel-Hillford Electronics Division, which produces telemetry, closed-circuit television systems for the Center and other programs and ground support equipment for the Atlas ICBM.

- **Power Equipment Division**, Cleveland, Ohio, will combine what formerly was Siegel's Jack & Horne Division, manufacturer of micro-miniature electric power generation and control equipment, and Leas's Electro-Mechanical and Low Voltage divisions. The latter two groups will be moved to Cleveland from Grand Rapids, Mich., and El Paso, Ohio, respectively. The division will be headed by K. Robert Holtz, formerly executive vice president of Leas, who now heads head of Jack & Horne Division.

- **Instrument Division**, Grand Rapids, Mich., operating primarily of Leas's Instrument Division and Three Instruments (AW Apr. 16, p. 18).

- **Defense Systems Group**, Santa Monica, Calif., bringing Siegel's Space Systems Technology, Group Technology, Calif., into a new space systems center.

These three have previously been divisions of Siegel's and Leas's groups. Its prime function will be to seek and market various representations.

- **Communications and Control Division**, New York, including what was Siegel's Marine Electronics Division and elements of its Graphic Radio & Television division.

Other divisions of the new company will be Graphic Radio & Television, the former Siegel's Graphic Division, Leas's Leas's Graphic Division, and Leas's Leas's Graphic Division, and Leas's Leas's Graphic Division, and Leas's Leas's Graphic Division.

A Leas-Siegler Research Laboratories Group has been set up in Santa Monica.

to be headed by I. T. Thomas, former Siegel corporate director of research. Leas's Solid State Physics Laboratory at Santa Monica was reported to Thomas.

John C. Rosell, former president of Siegel, will be chairman of the board of Leas-Siegler. Al Hancherich, Leas's president, will be president of the new organization.

Leas-Siegler is expected to have sales of about \$200 million during the 1969 calendar year. Corporate offices will be located in Santa Monica.

One of the Leas-Siegler firm's in the new corporate identity is an effort to emphasize on that company's role acceptance in the aerospace industry and a recognition that the Siegel name has not been identified in the past as possible with the activities of its individual companies or divisions.



XC-142 Propeller

United Aircraft Corp.'s Hamilton Standard Division, Windsor Locks, Conn., will produce the standard propeller for the XC-142 in service VTOL transport (AW June 10, p. 68). Hamilton Standard has been selected by United Aircraft Corp. for one of three major contracts in the effort to develop and manufacture strategic control propellers, located on left and the transport's four wing engine propellers (AW Dec. 11, 1967, p. 47). Propellers will consist of glass fiber blades fixed on steel spars.

Third-Level Service Transport Studied

By L. L. Doty

Washington—Local service airline industry last week disclosed plans to launch an immediate study of specifications and performance requirements for a short-haul aircraft designed to serve low-density traffic areas, where some government and industry officials feel should be served by a third-level class of carrier.

In a letter to Sen. A. S. Mike Mansfield, ID-Idaho, the Association of Local Transport Airlines (ALTA) proposed a basic program that would provide local service planes that would avoid employing the boundary line created presently to prevent short-haul aircraft from flying in small airports. The letter gave no further details on specifications, but Air America Week Journal that ALTA is considering a design employing two 1,000-hp turbine engines that will not need auxiliary propulsion. The aircraft would have solid take-off and landing capability, climb at about 4,000 ft. per min., operate at speeds up to 400 mph, at a cost of \$10 million.

ALTA urged that funds be expended to develop a prototype. The association made no specific recommendations as to whether the funds should come from manufacturers, the military, government agencies or a combination of these groups.

Conflicting Views

At least one member of ALTA is violently opposed to becoming involved in this type of operation and would prefer to use a new group of operators, take over some existing traffic-generating areas, finance, equipping the aircraft, ensure they have local service airlines currently serve this type of service and should make an effort to develop local airports. The letter to supplement this subsidiary in higher-density traffic regions.

Trial Flights

Before the aircraft is produced in volume, one or more of the models should be flown in actualized mode by a local service carrier out of the

Mississippi River, another west of the Mississippi and a third in Alaska, the group said.

ALTA will try to persuade smaller communities to release such aircraft as landing fees, rental costs and service expenses, and other airlines will be asked to release aircraft, crew and other resources and working loads.

The association asked a "tasking" of regulatory provisions and requests to permit economic and safe operation of the new service. Specifically, ALTA endorsed the use of two pilots as two operators are allowed to have a single pilot on some aircraft but it would like to eliminate the FAA's "one pilot rule" and request that ALTA also wants a modification of air traffic rules to simplify flight procedures in low traffic areas.

FAA Fund Requests Cut by \$100 Million

Washington—Budget Bureau panel says that \$100 million should be cut from the FAA's original FY81 budget request, including \$12 million of the \$17 million sought for civil aviation transport development, no increase in technical research and a House appropriations subcommittee.

Original sum requested was \$913 million—\$503,800,000 was approved. Appropriations Committee said the agency asked for in FY81 1985 was cut. But the Budget Bureau ordered FAA to reduce its operations budget by \$13 million, its facilities and equipment budget by \$10 million and its research and development budget by \$15 million.

As sent to Congress, FAA's budget limit authority for FY82 now is \$400 million. The agency is expected to lower expenditures of radar services in general and increased emphasis on radar standards as prime reason for the reduction.

Questioned closely by Subcommittee Chairman Albert Thomas (D-Tex.), FAA officials confirmed that at least \$115 million has been spent to date in attempting to develop a non-military traffic control system. CR that equipment represents \$28 to \$32 million, they said. The largest task was within FAA's \$50 million research and development request—\$16 million—was that the agency request a test of the system to be used to evaluate new ATC devices.

Asked by Rep. Thomas if it would not be better to let the military proceed with superior traffic control systems, FAA Administrator Haley replied "That is

just what we are doing." Earlier in the hearing, Haley predicted the agency would "lose a great deal" about national identification, scoring procedures, fuel performance and other issues and laboratory techniques from Air Force development of the RS-70.

Delay Asked In Action On Foreign Carriers

Washington—Civil Aeronautics Board last week urged Congress to wait the amount of a 10-day bill for action before acting on bills that would capsize the Board to regulate rates and schedules of foreign jet carriers flying to the U.S.

Approving before the House Subcommittee on Transportation and Aeronautics, Chairman Alan S. Boyd refused to recommend specific legislation on the subject until a previous bill, introduced by Sen. Frank Lautenberg, D-N.J., is passed. Composed of CAB, Federal Aviation Agency, Budget Bureau, and State, Defense and Commerce Department representatives, the committee will wait until the House passes it in early fall. Boyd said. Because it is impossible to adjust portions of international air policy in "little boxes," Boyd said Congress should "wait until it can consider the committee's report."

On this point, Air Transport Association President Stuart G. Tipton took sharp issue with Boyd. Everything should not come to a halt during studies. Tipton said. He said the subcommittee should not be so "paralyzed" that the trade probably would not be forthcoming until the first of next year.

Three bills have been placed before Congress—one by CAB and two by ATA. The Board bill would enable it to prescribe "assumable" rates for both U.S. and foreign jet airlines and to suspend tariffs that appear unfair. The first ATA bill would give CAB power to suspend or increase foreign tariffs but not to prescribe rates. The second would enable it to approve schedules filed by foreign airlines.

ATA has lodged three objections to the bill proposed by the CAB. One is that CAB does not need to be, suggest or investigate rates charged by U.S. jet carriers and hence should be empowered to do so. "What the Board needs is the power to suggest 'desirable' foreign carrier rates."

Emphasis of the CAB bill would be self-defeating in purpose. More, he said, is required by the U.S. to provide that the Board should be given the power to suggest rates that would be self-defeating in effect during the governmental negotiations that caused.

Rate-making is a multi-lateral process and CAB cannot impose its will on foreign governments.

BOAC May Buy CL-44 Aircraft For New Combined British Carrier

New York—British Overseas Airways Corp. is negotiating with Canadian LDC for the purchase of 10 CL-44 aircraft which would be operated by BOAC for the new BOAC-Canada joint venture (AWN June 11, p. 41).

The aircraft would be part of a fleet of 16 used by Canada, primarily as a company carrier, but with the agreement of the Canadian government that up to five would be bought for the Royal Canadian Air Force if some new aircraft are ordered.

Revised from Staff Airman and Richard Wood Airlines account for four of the aircraft. The Canadian government agreement calls for rental of one aircraft from the government-owned company for each one of Canadian's own airplanes used, to include five more would be obligated to buy, but not to lease.

If the BOAC order is completed, it will mark the first sale of the CL-44 to a trunk passenger carrier, and the first sale of the CL-44 to a Canadian carrier. Canada is to buy the CL-44s from the U.S. via delivery would be made this fall.

Talk and negotiation of the aircraft would be handled similarly to the 18 Boeing 720-200s from Canada and eight CRJ-440s which will be provided the new company, according to Sir Maurice Stacey, BOAC chairman.

In the case of the 720, BOAC-Canada is a joint venture of 16 aircraft will operate under Sir Matthew, in New York. To explain the new venture to BOAC's North American employees, and that BOAC-Canada will actually be certified to this equivalent of regional routes to be a subsidiary for 10 707s, or a total of 100 ft.

If BOAC-Canada in practice would be a regional carrier, 10 aircraft would fly, for example—BOAC will absorb other 10 to be absorbed into the other 10, if the new company would have the additional 10 to be 707 base or as Britannia, DC-9 or possible CL-44 type.

BOAC will crew, maintain, maintain and operate the aircraft, and charge the new company either by the hour or by round trip—which has not yet been determined—as a cost basis since the aircraft and direct costs will be absorbed.

Profit driven by BOAC-Canada from revenues of its joint venture will be shared with the British. The value of capital costs will be 10% for BOAC and 90% for Canada. Value of the air-

craft contributed to capitalization of BOAC-Canada is \$61 million and the two partners will pay up an additional \$16 million total in cash.

BOAC expects to supply all aircraft from existing capital. Sir Matthew said. The cash amount will be equivalent to the second development in the right airplane BOAC is contributing.

The 10 aircraft will be identical to the books of BOAC-Canada and will be down by the new company, but one hundred out of BOAC. They will be ordered in part by the order of BOAC-Canada will be provided aircraft from the other side.

Two more aircraft will be ordered from the BOAC-Canada venture. Sir Matthew said.

North American sales office of BOAC and Canada will be consolidated, providing enhanced sales capability and possibly additional aircraft or capital investment in facilities and equipment.

The latter sums for a medium-sized U.S. city might be \$750,000 annually.

Flexibility in meeting capacity requirements efficiently can be obtained better by giving the new company access, in effect, to the entire BOAC fleet. Limited to only 10 aircraft, the new company, model out in a small airline, Sir Matthew said, and small airlines face a similar problem in talking capacity to fleet.

Slattery-Trippe Meeting

Informal talks have taken place at the home of Sen. John H. Slattery, BOAC chairman, and John Trippe, president of Sir Matthew World Airlines. But Sir Matthew said, the discussion has not touched on a possible merger of the two airlines under Western Airlines (AWN May 28, p. 30).

"An American air great great bonds of Sir Matthew said, 'even though we are great allies of the world, which the BOAC, do not do.'"

One of the subjects discussed was put that, Sir Matthew said, "There is no way out of this."

The new airport-facility cutting out how to strengthen relationships was under discussion at the International Air Transport Association Executive Committee meeting at Montreal early this month. Changes in the British Airways, which is a member of the association, could play a role in a commercial expansion of operations of those other carriers who see potential proposed there.

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Investigation of ATC Center Shift Sought

Washington—Federal Aviation Agency plans to conduct an ATC center shift investigation in Texas and Louisiana but has been attacked as an "inconsequential" investigation by Rep. Henry Gonzalez (D-Tex.), who is seeking a General Accounting Office investigation.

Gonzalez charged, as well as others leveled at FAA continuing procedures in recent months will be conducted by the Senate when it passes the agency's Fiscal 1985 budget this summer. Earlier, the Senate indicated it would demand a thorough independent investigation before endorsing the agency's next major research and development effort (AVW Mar. 16, p. 40), which is to follow recommendations of the Project Houston report on air traffic control.

Immediately at issue in the media and legislators of FAA's conducting of most simulation work of emergency and Fiscal 1985 funds to build a new Air Route Traffic Control Center (ARTCC) in Houston. Conversely, the agency would close down existing centers in San Antonio and New Orleans for reasons of "operational safety and economy."

Neither point was mentioned when FAA officials testified before the House Independent Office Subcommittee on the agency's Fiscal 1985 budget.

San Antonio has within Gonzalez's constituency. Houston, at the same time, is the home district of Rep. Albert Thomas (D-Tex.) who is also chairman of the independent office subcommittee. Gonzalez, according to Gonzalez, FAA's ARTCC investigation cost involves far more than the element — "a simple contract between two governmental organizations."

The \$7,742,000 FAA would direct over was considered for 27 Terminal VORs—very high frequency navigation stations built at airport landside—9 single-channel VHF transmitters in agency Flight Service Stations and other ATC representatives, Gonzalez charged. He attacked was reflected in a 11-page statement heard by Thomas' subcommittee last week.

FAA's first explanation of how it would use \$700,000 annually to the consolidation "was not adequate," Gonzalez said. Then, he asked, could such a saving be realized after FAA had just finished a \$100 million building for a new center in New Orleans, also it had paid \$819,000 to test for needed facilities, also it had built another new center at Houston and just received approval for \$15 million.

Gonzalez then lodged an objection to the move in the form of a letter to FAA Administrator N. E. Holtz.

Holtz replied that the consolidation had been "extensively studied." Gonzalez said, and the center would be closed on Sept. 1, 1984. In this exchange, Gonzalez said, Holtz dropped his concern of the annual saving to be realized by the move from \$700,000 to \$180,000.

But Gonzalez disputed even this estimate, he said, it was based on the replacement of a single ATCC component of an unknown type at Houston as opposed to two at New Orleans and San Antonio. "Take out the \$5,154,000 saving on the rest of one unit (center) and the agency has savings left," he said.

Gonzalez asked the agency if "post measurement" is a strong

to develop a specialized type of computer for use as a non-emergency ATC system and said FAA had already spent more than \$50 million in this area (AVW Mar. 14, p. 38). A movable model has not yet been perfected, Gonzalez said.

Without "definite contract" that a computer would be purchased at Houston in 1976, Gonzalez said, "no one knew or in the agency that these savings in the Houston move in the next 10 years."

Questions based on these allegations were forwarded to the congressional general committee. Before testimony was given to FAA's request it should meet GAO's report, Gonzalez said.

Houston Plans 'Supersonic' Airport

By Erwin J. Dolan

Houston, Tex.—Start in construction of a new international airport, designed to handle supersonic transports, has been made by Houston city officials with approval of plans and specifications for its initial runway. But no being sought with a return date of June 27.

Houston's international airport, which will supplant Houston International Airport in the mid-1980s, embraces a program which is expected to use more than \$100 million by 1979 and make a determination by that city to establish the airport. The downtown traffic center in the southwest region in both domestic and international operations.

International airport will be located on a 6,500-acre site 15 mi. north of downtown Houston and approx 10 mi. from the present Intercontinental Airport. A major consideration in its location has been to provide the new facility to relieve the airport as well as to ease air traffic management problems.

A problem in the current airport is the fact that there are about 11 parallel runways and taxiways and a taxiway in use within a 25-mi. circle, with the taxiway base only five miles from the field. This necessitates construction of taxiway and taxiways from both airports. Approximately 450 taxiways and taxiways currently are recorded daily at Houston International and the field is served by 10 runways. Among those, RLM and San Antonio provide direct service to Europe and beginning Feb. 1, Brazil and San Antonio will provide through-flight service to London and Frankfurt via Dallas and Chicago.

Initial construction embraces a second runway of 8,000 ft which probably will be completed in two years. The city is asking bids on concrete thicknesses of 12 in. and 14 in., although FAA wants for this class field concrete thicknesses of 18 in. and 12 in.

The major runway system of the airport will embrace two additional parallel 11,000-ft runways, each having parallel dual taxiways with high-speed turnoffs, capable of handling wheel speed of 50 mph. Plans to have no intersecting runways at Houston. Primary runway will be staggered, so that the leading runway is positioned farther south than the second runway. This layout, with the terminal building between the primary runways, will place departing aircraft in isolated position with minimum turning. On landing, the taxiways will be used to allow aircraft after landing to reach the terminal.

The city currently is waiting special permits for the initial project runway, which will be built to 8,000-ft length. The city is also planning to build a 12,000-ft taxiway. Construction on this runway is expected to start in mid-1981. Ramp area around the terminal building is being used for construction in mid-1981 and the city expects that it will begin operations at the new international airport in late 1985 or early 1986. Construction through this period is estimated at \$55 million—including \$65 million in federal funds.

Cost estimates, including those for auxiliary terminal building will handle 40 aircraft monthly with an ultimate capacity of more than 90 planes. Costs are planned to measure distance from the terminal center to the new distant gate position will be 1,000 ft.

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Airlines Weigh Value of Radiotelephones

By Ward Wright

Washington-Widspread airline acceptance of Bell System's air-ground radiotelephone network for passenger use await a considerable increase in available communication channels and a tightening of the airline financial picture.

With few exceptions, airlines communication men, who have been watching the progress of Bell's air-ground radiotelephone system since its beginning (AW Jan. 27, 1958, p. 98), have indicated they will take a hard look at the value value of the system before committing their airlines to any equipment program.

Only American Airlines has introduced an early test of the system. Bell's air-ground radiotelephone unit, which completed in 1954, will consist of 72 ground stations throughout the U.S. that will allow a passenger flying anywhere in the country to make and receive calls from almost anywhere in the world. Calls could now be made to passengers flying in other projects equipped similarly.

The traditional cost attitude toward the system stems mainly from an essential question concerning the adequacy of present and proposed air-ground radiotelephone service, its value and its cost.

Experience Limited

During the experimental phase beginning in 1957, only three airlines—Northwest, Capital and United—participated in the tests. Of these three airlines only two are now operating and each one of these had very actual passenger experience with the air-ground system.

Northwest had air-ground passenger radiotelephone installed in four of its Boeing 737 Stratliners which were later removed before the aircraft were sold. United's air radiotelephone was installed in President W. A. Patterson's personal aircraft. At present no air-ground radiotelephone service is in service on any airliner.

The main question trouble communication officials have about the system is how much real service passengers will get from the air channel Bell and Federal Communications Commission are currently proposing for air-ground radiotelephone use.

All airline communications officials questioned by Aviation Week noted that there could be situations in which the air-ground radiotelephone would be of considerable value to airlines generally. However, most noted that when these stations ring the limited number of channels available would almost nullify the system's value.

For example, they say, when an aircraft loaded with passengers is unable to land at its destination due to weather or operational difficulties and is diverted to another airport, it would be most useful for passengers to be able to notify homes and offices of the change. However, under proposed class and priority, cities such as New York, Chicago and Washington might have only one channel each—enough for one call at a time.

More Stations

Aircraft operating at altitudes of 23,000 ft. and higher may be able to use as many as four ground stations, Bell engineers believe. But even this added capacity would be quickly absorbed if more than one transport had to be diverted.

Such situations might be eased by having groundstations make lists of aircraft en route and calling them in to advise ground personnel, who could rely, then, on unutilized telephone facilities.

Another possible solution is channel splitting. The present proposal before FCC calls for six pairs of channels with 50 kc spacing. Each channel would be composed of a pair of frequencies one for the ground station and the other for the airborne unit.

Channel splitting would give 12 channels with 25 kc channel spacing. FCC often has this as a possible solution should additional radio spectrum not be made available for air-ground radiotelephone use. Ultimately, public demand will determine whether more spectrum is set aside for such use.

Channel Scarcity Cited

Airline communications men feel 12-channel equipment with 25 kc spacing is beyond the state of the art for practical service use at this time. A spokesman for American Radio, Inc. (Aircraft), an active aerial organization which operates their ground-side facilities and a coordinating national radio between Bell and the airlines on the air-ground radiotelephone, said he felt "40

to 60 channels would be needed to do a good job."

Another factor being weighed is an inherent danger of a valuable passenger service that will build good public relations. The other situation that due to the limited number of channels, the frustration from being unable to place calls may leave the opposite effect.

There are two schools of thought on this. One holds that air-ground radiotelephone is a valuable passenger service that will build good public relations. The other maintains that due to the limited number of channels, the frustration from being unable to place calls may leave the opposite effect.

A communications official for National Airlines expressed optimism for the air-ground system. He felt the traveling public will want it and indicated National might begin it when Bell's ground facilities are expanded to encompass a greater part of National's route structure. United Air Lines also expressed optimism interest in the system.

A communications official for Northwest, the only airline airline having passenger experience with the radiotelephone, said that when the first radio units were installed in 1957, initial passenger use was heavy.

In time after the speech were all radiotelephone are shifted down to a small number of business people. If this is to be the pattern of future operations he said, he doubted whether the initial boom would justify the expense. He said he would not try to sell Northwest management on air-ground radiotelephone equipment at this time.

Service Application

An Eastern Air Lines communications executive said his airline was evaluating the system from a "look-see" standpoint. Personnel he said he felt it was "highly questionable whether an aircraft would do the job." An Eastern sales official said the airline was evaluating the radiotelephone from the angle of its usefulness as an electronic emergency device. He said other operators he felt it "wouldn't be long as a done."

A communications chief for a transline operating in the Northeast U.S. described the system as a "game" as far as transline use is concerned, but admitted the system was valuable for business aircraft. He felt the radiotelephone system should await further development of communication satellites, which could provide sufficient channels, rather than exploit Bell's present ground station concept.

A third question in the minds of airline communications officials is cost. At least three transline communications officials felt that with the airline financial picture what it is today, that is a poor time to begin planning equipment

Anti-Collision Conference

Washington-Federal Aviation Agency has scheduled an industry conference here July 12-13 for discussion on the potentialities of airborne collision prevention system in air traffic management. The conference, to be held at the Mayflower Hotel, will be open to representatives of industry and to support men. Progress to date in evaluating several experimental systems and techniques will be reported.

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perhaps for a system with such little power output.

The only currently manufactured radio telephone for marine use is General Motors' Delta Radio unit which is expected to sell in the neighborhood of \$1,500 when it is marketed. Development of the unit was recently transferred from GM's AC Spark Plug Division. Installation costs for the 25 lb. unit in 9 in. x 18.7 in. unit are not known at present. A Trans World Airlines communications officer said he thought \$7,000-\$8,000 was a realistic total price for equipment and installation. He added that TWA had an "open plan" for installation now. Northwest said it cost about \$1,000 to install the unit in its fleet.

Under the present Bell proposal, the airlines would have to buy, install and maintain their own equipment.

An American Airlines communications officer said he believed the airlines would ultimately have to share at the expense from the cuts to offset the cost.

Bell's proposal now before the FCC for rule making calls for six pairs of FM channels at the 475 mc. mobile band.

In addition to six frequencies, a common signaling channel on a frequency of 474.99 mc with a 45 kc. deviation would be provided. This channel would allow air and ground stations to notify each other electronically, since calls were coming in.

Ground stations will be placed about 250 mi. apart. Transmission areas of adjacent ground stations will have some overlap and will be managed different channels to prevent overlap. Some in nearby areas have existing signals. The nearest co-channel stations would have 500 mi. spacing. The system gives an emergency range to aircraft flying above 5,000 ft.

Each ground station would transmit a "dual tone" on its own channel. A power-up warning to make a call would select channels and be heard one with the channel dual tone (relating to the band) the correct channel of the nearest ground station. The ground station would then be alerted over the common signaling channel and the call placed. Airborne calls would be received at Bell's coast guard.

In a ground-to-air call, the call would have to give the operator some guidance such as airline name, flight number, approximate location of the aircraft, destination and times of departure and arrival. Once the aircraft's approximate location had been determined the operator would route the call to the ground station nearest the aircraft.

The operator would then signal the aircraft over the common signaling channel by giving the aircraft's identification number followed by an address.



Douglas Tests Mach 3 Transport Model

Douglas Aircraft Co. engineers pose a 1/10-scale model of a Mach 3 (2,000 mph.) jet transport for one of a series of wind tunnel tests at the company's Ames Research Laboratory. Douglas recently received seven contracts from the Federal Aviation Agency to study materials, aerodynamic and structural phases of supersonic transport designs (AW May 25, p. 20). Under the contracts Douglas is teamed with McDonnell Aircraft Corp. The work is part of FAA's studies to determine whether the U.S. should authorize development of a civil supersonic transport. Douglas and McDonnell will contribute \$200,000 each to the study during agreement with FAA, which is handling the contract for \$395,000.

tical data identifying the ground station before channel. The proper talking channel could then be selected or indicated for the passenger who then may take the call.

A passenger receiving a fading signal as his aircraft leaves the range of the ground station would push the button to signal the operator. The operator would then route the call to the nearest ground station. The passenger would then be instructed to the new channel.

Although still in the developmental stage, the Bell program seems to be presently operating like a station post, instead of a network, among the most heavily traveled air routes in the northwestern U.S. Early last month FCC

authorized five new development stations to be located near El Paso, N.Y., Berkeley, W. Va., Denver, Okla., Vancouver, Ind., and Boston.

After June 15, Bell's experimental system will be made for operation as proposed, having an 18-minute delay in the FCC. The new system, coupled with the first now operating, will give Bell complete coverage of the quadrant of the country north of Virginia and east of the Mississippi.

After that expansion phase, Bell says the next step is to extend coverage to a strip between San Diego and San Francisco. From there, Bell says it will expand its ground station facilities into the Southwest to link Florida and northwestern air routes.



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SHORTLINES

► Boeing Co.'s jet aircraft scheduled service has carried 25.5 million passengers and flown more than 600 million miles. The company says it has delivered 260 commercial jet aircraft, now operating with 35 airlines.

► Delta Air Lines has asked for temporary authority to serve Houston, Ala. as its northern transcontinental route to Los Angeles via Dallas-Ft. Worth, pending Civil Aeronautics Board action on its request for permanent authority. Delta and the route would link Marshall Space Flight Center at Huntsville with other major test and launching facilities in Texas and the West Coast.

► Eastern Air Lines has opened a 300-space parking lot at Logan International Airport in Boston with a free bus shuttle linking the lot with the Eastern terminal. Parking lot prices will be equal to those of other airport parking facilities.

► Flying Tiger Lines bought traffic for May in the New York-Newark, Los Angeles and San Francisco markets now 37% over the April total. The carrier attributes the increase to introduction of Canadian CL-44 jet fighters in their May last month.

► Icelandic Airlines this month took over cargo services, dispatching and maintenance at Iceland's Keflavik Airport. The services were formerly performed by the Icelandic government.

► International Flight Information Manual listing entry, passport, visa and public health requirements, reports of entry, and regulations and notifications for 14 foreign countries and islands is available from the Superintendent of Documents, Government Printing Office, Wash. 25, D. C. for \$4.

► KLM Royal Dutch Airlines will begin service on July 9 between Amsterdam and Dubrovnik, Yugoslavia, in route to Caracas on the Adriatic Sea. Flights using Convair 440 equipment will leave Amsterdam every other Monday and travel via Marseille to Dubrovnik.

► Pan American World Airways has begun jet service between Miami and St. Croix, Virgin Islands with two coastal trips weekly. Flight number 5 hr., with a 45-min. stop in San Juan.

► West Coast Airlines flew 11,851 passengers in May, 1962-10.3% more than May, 1961. During the same month, revenue passenger miles increased 10.9% over May, 1961.

AIRLINE OBSERVER

► New four-engine Soviet transport with two powerplants mounted in single pods on either side of nose fuselage (AN-10, 19, or 21) under development by Ilyushin design group. Planned designation is IL-62. It is expected to be operational by 1964 or 1965.

► Despite a disappointing volume of Montreal Day tourist, domestic transatlantic traffic climbed 11.7% during May and local service revenue passenger miles rose 17.1% over the same period last year. Transatlantic load factor, however, dropped to 51.9%. First-class revenue passenger miles fell 30% in May, while coach traffic climbed 10.2%. Available seat miles for the transatlantic in both categories climbed 19%, while local service available seat miles rose 14.9%. Local service load factor for the period was 41.7%.

► Northwest Airlines has purchased three Boeing 707-320B transports powered by Pratt & Whitney JT10-3 turbojet engines for delivery in June and July, 1963. At the same time, the carrier ordered two additional Boeing 720B turboprop medium-range transports to bring its fleet of the model to 11. Purchase will be financed through modification of prior credit agreements and from cash company cash resources in depreciation reserves.

► Egypt's United Arab Airlines over substantial issues for intensive travel to other airlines among Egypt. Problem is regarded as political rather than economic because the Egyptian government will not permit the airline to join International Air Transport Association, thereby losing, which hampers airline profitability. At least one airline, British Overseas Airways, is planning to terminate its share agreements with the Egyptian carrier.

► Department of Commerce survey of Central and Caribbean area finds market potential for used and new aircraft in these sections is limited, although the U. S. will continue to let the general equipment for use as a last resort. Of all countries in these areas, Mexico offers best market potential, but the survey warns that future exports will face growing competition from the small but growing Mexican aircraft industry.

► United Air Lines has authorized use of such portable electronic equipment as standard radios, recorders and dictating machines by passengers in flight. Operation of FM radio receivers is still banned and pilots also request passengers to refrain from using other electronic equipment when instrument flying conditions prevail.

► Aeroflot has added an innovation to its Mi-4 helicopters: electric service between downtown Moscow and Vladimir and Shcherbakovo airports. Flight attendants now serve in the cockpit, reducing 1 table 16 laps—about \$1.66-hour each journey. Regular airport-city helicopter schedules were suspended during the winter.

► Canadian Air Lines will inaugurate four linerless service to passengers connecting with Continental from other carriers at Chicago's Midway Field and Los Angeles International Airport. The long distance between airline locations at the Chicago airport is explained by the fact that first time between flights will be cut to 10 min. by use of the linerless service.

► Eastern Air Lines has closed 16 city ticket office throughout its network at locations where operating costs were unreasonably higher than gate ticket sales.

► Frontier International Airlines, which entered the transatlantic market a year ago, is planning its next move expansion centered to Tokyo and Bangkok. The criterion probably will not be introduced for a year or two, but bilateral agreements already have been negotiated. Meanwhile, the airline is studying the Boeing 737 and the BAC 111 as a replacement for Viscount series in domestic service. The 737 is favored over the de Havilland Trident, but there still is some question as to whether the Boeing plane may be too large for the carrier's requirements.

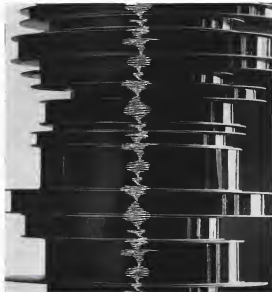
► Association of Local Transport Airlines has moved its group to meet with a Civil Aeronautics Board committee to work out a plan to reduce subsidy. No date for the meeting has been set.

Airline Traffic—March, 1962

	Revenue Passengers	Revenue Passenger Miles (\$000)	Passenger Load Factor %	U.S. Mail Ton Miles	Express Ton Miles	Freight Ton Miles	Total Revenue Ton Miles	Over All Revenue Load Factor %	
DOMESTIC TRUNKS									
American	448,768	472,851	54.2	3,561,370	1,353,319	12,423,353	84,653,916	51.0	
Boeing	222,132	13,444	34.3	382,198	1,211,854	11,122,646	13,122,646	43.4	
Continental	114,801	77,243	43.9	330,111	111,267	779,351	9,171,693	37.4	
Delta	340,964	230,279	61.8	881,720	190,448	3,174,369	30,468,462	52.1	
Eastern	492,235	311,417	58.7	1,041,207	464,611	1,726,716	27,418,113	45.5	
Norfolk	173,801	131,961	51.3	440,024	49,719	1,251,346	14,326,302	41.8	
Northwest	153,828	72,499	53.4	547,979	14,822	223,637	3,938,226	46.7	
Trans World	182,254	303,411	60.4	733,764	289,272	1,417,219	17,272,216	40.3	
United	383,130	134,123	49.9	1,011,464	1,235,845	4,238,265	46,172,845	44.2	
Western	194,658	121,454	50.3	1,181,615	1,073,582	38,497,584	73,345,445	46.5	
Western	123,814	87,182	50.3	221,920	107,582	436,641	9,739,503	41.1	
INTERNATIONAL									
American	18,674	11,496	61.2	4,488	823	307,237	1,496,149	61.8	
Boeing	9,110	12,334	60.3	4,488	823	307,237	1,496,149	61.8	
Continental	40,269	3,220	60.3	4,488	823	307,237	1,496,149	61.8	
Delta	911	1,248	26.8	1,679	—	—	150,815	30.6	
Eastern	43,123	61,454	59.3	547,034	2,094	421,234	6,233,299	50.3	
Norfolk	13,474	2,353	49.9	276	8,287	239,884	38,6	38.6	
Northwest	15,485	37,341	58.8	1,932,374	2,172	915,945	6,779,901	58.2	
Trans World	2,936	2,370	26.4	49,448	3,913	30,419	405,239	39.3	
United	135,313	184,817	61.2	2,376,423	7,812	79,482	29,482,159	51.3	
Western	119,105	184,451	61.9	4,027,054	16,988	2,128,211	27,242,707	63.6	
Western	43,443	174,857	45.1	4,027,054	16,988	2,128,211	27,242,707	63.6	
Western	13,465	31,454	70.3	1,364	—	—	3,338,284	64.4	
South Pacific	124	345	23.3	1,364	—	—	10,544	21.4	
Trans World	2,937	34,184	42.8	—	—	—	1,419,979	18.9	
United	23,817	26,479	52.3	2,423,232	—	—	12,147,181	39.3	
United	16,263	46,444	47.8	389,480	12,261	327,433	6,837,779	34.4	
Western	6,992	5,374	46.1	8,617	—	—	7,088,488	54.6	
LOCAL SERVICE									
American	49,862	14,827	26.3	31,323	42,416	91,729	1,578,942	41.4	
Boeing	32,618	9,340	30.8	7,754	2,232	15,149	642,488	56.8	
Continental	28,819	9,811	38.1	20,545	10,411	20,053	622,221	36.3	
Delta	26,647	7,817	34.0	23,674	11,720	40,229	846,251	30.8	
Eastern	20,939	5,739	38.4	11,495	16,988	21,436	607,430	39.9	
Norfolk	82,781	14,844	39.3	68,467	49,222	66,435	1,544,769	40.9	
Northwest	55,368	6,362	44.6	21,916	30,621	37,720	912,538	40.9	
Trans World	38,812	7,764	47.4	11,823	11,823	88,826	88,826	47.4	
United	44,935	5,315	45.3	76,328	16,431	30,431	940,944	42.7	
United	33,044	6,714	20.3	26,417	17,033	715,918	715,918	20.1	
United	30,288	7,984	38.0	21,917	13,103	31,568	705,411	34.4	
United	30,288	7,984	38.0	21,917	13,103	31,568	705,411	34.4	
HAWAIIAN LINES									
Aloha	18,814	3,843	67.7	2,212	—	—	316,881	50.9	
Hawaii	18,814	4,950	59.3	8,177	—	—	142,500	34,819	27.8
CARD LINES									
American	—	—	—	—	—	—	146,420	188,823	43.0
Boeing	269	5,171	48.5	34,443	29,143	18,178	28,318,484	79.4	79.4
Continental	—	—	—	—	—	—	2,376,944	3,810,434	64.4
Delta	4,345	26,831	61.8	11,479	879	2,376,944	3,810,434	64.4	64.4
Eastern	—	—	—	—	—	—	4,816,229	6,616	64.4
Northwest	—	—	—	—	—	—	8,912,442	2,376,944	74.8
Trans World	—	—	—	—	—	—	—	—	—
United	—	—	—	—	—	—	—	—	—
Western	—	—	—	—	—	—	—	—	—
HELICOPTER LINES									
Chicago Helicopters	8,876	149	22.4	1,374	1,483	—	18,981	34.9	
Los Angeles Airways	—	174	38.4	8,182	2,871	—	28,912	43.4	
New York Airways	13,076	240	46.9	432	792	563	29,121	49.1	
ALASKA LINES									
Alaska Airlines	8,846	5,774	33.6	87,208	1,812	408,262	1,346,681	52.0	
Alaska Central	2,220	220	56.7	3,619	—	8,838	42,764	63.7	
Alaska Western	378	378	—	3,619	—	3,619	18,844	46.2	
Alaska	736	736	36.5	3,619	—	3,619	5,347	43.3	
Alaska	3,264	326	71.1	33,433	33,433	304,919	204,919	26.2	
Alaska	7,823	8,886	23.3	150,136	9,371	374,813	1,173,812	32.6	
Alaska	647	1,674	42.3	—	—	54,396	36,717	35.6	
Alaska	3,273	940	35.4	97,632	—	861	6,776	38.8	
Alaska	—	—	—	—	—	152,427	396,812	50.8	
Alaska	4,445	242	42.8	400	—	2374	29,285	46.1	

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Star-Field Tracker Confirms Attitude Data

By Philip J. Kline

Rome, N. Y.—Non-emitted attitude sensing for space vehicles called a star-field tracker, which eliminates the need for gyros and starboard platforms, is undergoing tests here at General Electric's Advanced Photonics Center. The experimental model weighs 25 lb, but a production design seems likely which will weigh a total of 10 lb, according to Lawrence Stenstrom, project engineer.

New devices, like a conventional inertial navigation system, can be used to establish a precise direction in space. But because it makes use of a multiple star field for reference, it also provides data on the vehicle's roll, pitch and yaw attitude with respect to the sun.

Unlike a single star tracker which must be aimed close to the star it is to track to prevent locking onto the

wrong star, the new star-field tracker is expected to be able to event itself by comparing the configurations and locations of the star field it sees with a known map of a portion of the celestial sphere.

Practically, tests to date, using an artificial star field, have confirmed predicted performance and the device roll should be covered outside for tests using the natural star field, Stenstrom says.

Concept of a star-field tracking device is not original with GE. This problem is more difficult than it appears at first examination. A star-field tracker must be able to determine the desired field configuration regardless of its angular orientation.

The most recently proposed design approach entails using a digital computer to perform the complex task of correlating with a preselected map of the celestial sphere, a large number of photo-detector elements, or both.

General Electric has attempted to

substitute photo-optical segments for such complexity in its design. The outlining of the current star field with the desired star field is performed optically in such a manner that a single photo-amplifier tube senses in its electric and correlation, and no computer is required.

Theoretical analysis, tentatively confirmed by tests to date, indicates that the device will be able to detect vehicle attitude changes as small as 10 sec of arc in all three axes.

Star-field tracker consists of an objective lens which focuses the parallel light from stars into a point at the focal plane of the lens, beyond which the light rays begin to diverge. (See sketch.) Beyond the focal plane is located the reference map of the star field, part of the optical system which contains small etched holes, each located to correspond to the position of each star.

Holes in the reference map are in a precisely scale similar to the diverging beam from each star to provide an indication of tilt misalignment of the device with respect to the star field.

If the star tracker is properly aligned with respect to the celestial field, the light rays from stars will pass through the corresponding hole, in the reference map, and then will be focused by a second lens to converge on the "correlation plane" at which the photo-detectors are located.

When the tracker is precisely aligned, the light rays from all of the stars will be superimposed into a single spot on the photo-detectors. If the tracker is tilted slightly, indicating a deviation of space vehicle attitude, de-focusing occurs and the spot on the photo-detectors will be modified and slightly elongated in the direction of tilt. This provides a cue used that gives both the magnitude and direction of the tracker/vehicle tilt with respect to the reference celestial field.

The digital control which directs the star map, selecting the celestial field with respect to the reference map, the superimposed star map spot on the photo-detectors will increase in size and become an asterisk. This provides a cue used that gives both the magnitude and direction of the tracker/vehicle tilt with respect to the reference celestial field.

To enable this sensitivity, the computer model uses a reference map which contains two complete star fields representing the celestial star

field. One set of the holes is tentatively displaced with respect to the other to provide two separate correlation functions in which the difference between the two outputs indicates both the magnitude and direction of celestial misalignment.

The reference map on the engineering model is a copper disk in which the celestial star-field patterns have been etched by a conventional photo process. During the initial star field alignment mode, the reference map is rotated by a small servomotor in the tracker until it is correctly properly with respect to the celestial star field, as indicated by correlation of the spot on the photo-detectors.

Engineering model uses a General Electric 10-15 van camera lens with a 2 1/2 inch length and a 40-deg. field of view for the objective lens. The field lens is an f/10.9 stacked biconvex unit with a 1 1/4 in. field length. Analysis of requirements are being done by the lab because the correlation function takes place at the reference map and the field lens need only serve as a light collector, Stenstrom says.

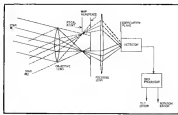
The device uses a rotating FM tape shifter with a split mirror and an AN/SP-43-A radiation photomultiplier tube with an S11 surface for the detector. For use in a space vehicle, the GE device initially must be pointed to within approximately 10 deg. of the center of the celestial star field to which it is to align itself and the vehicle for the correlation technique to perform properly.

Assuming that the vehicle is traveling in the ecliptic plane, the device does not appear to be a difficult requirement to build. One possible improvement would be to use a single detector tube instead of two tubes which GE has considered in so as a single shadowless unit which could also align the vehicle to the sun so that any of a preselected number of star-field trackers could be used in the sun. The star-field trackers would then seem by rotating about the sun.

In one evolution of the star-field tracker into a inertial unit, it would look at two known star fields, the one being the ecliptic plane from above and the other being it from below. By allowing one of these in the reference map in the device, it would be able to initially assume an attitude reference in within 10 deg. without use of manual reference for pre-orientation.

The correlation technique which GE uses measures the quantity of light difference from planets or nonstellar light sources with the field of view, Stenstrom says. Additionally, it provides attitude sensitivity because light from second star is focused into a single spot on the photo-detectors. Part of the

light rays are that the star-field tracker can be used with stars down to third or fourth magnitude.



STAR-FIELD TRACKER consists of objective lens which focuses light from stars to point, after which they diverge slightly before passing through reference map holes. Light rays are focused by objective lens, focusing them onto photomultiplier. Map holes track a precisely selected in azimuth, pitch and roll, all the images will be focused on a single spot.

New Radar Device Sorts, Displays Weather Information by Altitude

A new screen, for ground-based weather radar, which sorts out and displays weather intensity at each of six different altitude layers or individual scans, will now be delivered to USAF's Rome Air Development Center for evaluation.

The new constant-altitude plot-position indicator (Cappi) is designed to use with the widely deployed AN/CPS-9 weather radar and its Weather Bureau counterpart, the WSR-57. The equipment set designed and built, under RADC contract by the Aerospace Division of Ansonia Metals Fabricating Co., Bethune.

Existing weather radar scope displays range of a wide range of altitudes. By using a single scan because of the angle reflect the radar beam under with respect to the horizon. Thus, the lower portion of the scope displays prospects for a low altitude while the upper portion of the scope shows rainfall at high altitudes.

A more convenient display for use by pilots, however, would be one in which all of the returns or echoes returned were displayed on one scope, while those at various altitudes were shown as needed. This is the function that Cappi performs, being able to display returns at six different altitude levels selected by the operator. The equipment merely for earth curvature so that the altitude layer displayed as, in effect, rays of light seemed the earth's surface.

The six radar scan tubes are photographed onto a single 15-in. film strip which is developed automatically at one

minute and then projected onto a ground glass screen. The technique film program was developed by General Electric's Advanced Photonics Center.

To enable an operator to study the progress of a storm, the equipment permits vertical projection of any return on the film. Green and red films are provided so that the current situation can be displayed in one color while the other situation is superimposed in the second color.

The equipment uses 5-in.-dia. cathode ray tubes whose depth is magnified approximately 1.5 times when projected onto the screen. The projected display is bright enough to permit viewing in a room with an ambient light of luminance level of 90 foot-candles, Ansonia says.

Principle of Operation

The Cappi equipment controls the elevation angle of the weather radar automatically so that in pencil-shaped beam sweeps at 30 deg. of elevation every 10 sec. of time. The returns are shown on a screen of 15 minutes in diameter. Also the 15th altitude, the returns are automatically depressed to zero degrees elevation angle and the screen is repositioned.

As any particular elevation angle, the signal returns from rainfall are separated according to the altitude layer at which they occur, a function of their short range and accurate elevation angle, and displayed on the appropriate scope.

At any instant in time, only a narrow band on each scope will be painted, but during the course of the complete 15



STAR-FIELD TRACKER, engineering model of an attitude reference system for space uses, also requires no manual intervention. Unlike single star tracker, the new device also provides attitude reference about roll, pitch and yaw axes.



DISASSEMBLED VIEW of engineering model of General Electric star-field tracker shows (1) objective lens, (2) reference aperture, (3) focusing lens, (4) rotating shifter wheel, (5) photomultiplier tube, (6) correlation unit, (7) servo motor, (8) control unit, (9) reference map, (10) field lens, (11) camera lens. 25 lb, but production version should weigh under 10 lb.

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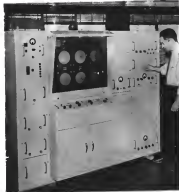
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NEW WEATHER RADAR ACCESSORY sorts out and displays weather intensity at each of six different altitude levels on individual scopes. New device was developed by Avco's Aerospace Division for Route Air Development Center studies.

severely retentive, each at a different elevation angle, the two exposed 15 mm film frame will obtain a full scope picture.

The Avco's equipment uses a big surface resistor with a dynamic range of 75 db, enabling it to determine color intensity without manual readjustment of the gain control.

The color intensity is quantized into seven levels, one of which is the background noise level.

The other six can be selected as a contrast of 5 db or 10 db.

All seven levels are available for recording on tape or processing in digital equipment, but only four levels of them intensity are presented on the scope display.

The first intensity display level is used for background noise, with the second, third and fourth levels presented as increasingly bright levels. If the one of a storm produces an echo which is code level four, it is treated and shown as a black hole in the center of the screen's light storm area.

The equipment can also process for equating the intensity of all six altitude ranges so that each gain level on all scopes has the same intensity. Range markers can be displayed on the scopes, if desired.

The Avco's equipment is capable of producing a new situation display every minute, if the radar returns return prevent this speed.

When used with the AN CPS-9 as a new display can be produced every five minutes.

The Cops display is mounted in a canister-type cabinet which measures 66 x 58 x 28 in deep. The cabinet contains the transposition display, radar receiving and video processing equipment and the antenna program meter.



Fading Law Radiation Effects: In direction of radiation generated in optical waves with target material is to be investigated as an effort to develop methods in an effort to develop methods in a program sponsored by the Air Force's Special Weapons Center in a computer program. AFWAC will explore one of its own difficult problems in the field—the measurement of high-intensity radiation. The letter program, scheduled for 15 months duration, will require a study of experimental methods, then the analysis of data.



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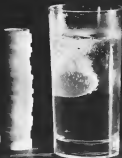
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methods and development of devices for exploiting these methods.

► **Signal on the Demand Line**—Major contract awards in various communications unmanned aircraft include the following:

► **Pan American World Airways**, \$1 million contract to provide facilities for development and testing of advanced aircraft; system of Avion Electronic Paving Grounds, Fort Hanks, Ariz.

► **Southern Gas Co.**, Great Neck, N.Y., supplemental contract for \$7 million for instrumentation of C-4 ships to be used on Atlantic Missile Range.

► **Collins Radio Co.**, Dallas, \$1.2 million contract for AN-114 multiple equipment to be used at 23 stations of a Vostok insurance system to be installed in the Central Treaty Organization (CENTO) countries of Turkey, Iran and Pakistan. Company also reports a \$2 million contract from Lockheed Radio, Inc., for C-5000 communications switching system to enter contract Army communications center in New York with active offices through out the country.

► **Minneapolis-Honeywell Automatic Division**, \$1 million second source award contract to cover testing and initial production of gyroscopes for North American Automatic Division, to be used in Minuteman ICBM.

► **Raytheon Surface Radar and Navigation Division**, North Dighton, Mass., \$1.6 million contract for AN-SPC-51 for control radar for use with Tartar deployment missile. Company also has received \$4.4 million Navy Bureau of Ships contract for production of sonar transducers to be performed by Raytheon's Sonar/Sensor Signal Operations Division, R.I.

► **Controls for Radiation**, Inc., Concord, Mass., research contract from Raytheon Development Center to develop software of Radiation X radiation generator. It has high powered tube equipment.

► **Joint-venture association of Page Communications Engineers**, a Northrop subsidiary, River Contractors, Corp., 14 World, a subsidiary of Minnesota Machine Co., and Cramer & Co., Great Falls, Minn., will construct Minuteman missile communications network.

► **Bowen**, A.B. S. D., under \$5.5 million Air Force contract.

► **Transtek Electronic Corp.**, Waco, Tex., \$778,000 award from North American's Avionics Division for high reliability communications system in Minuteman guidance system.

Also \$3.3 million subcontract for several structural packages to Radio Corporation of America's Data Systems Division, Van Nuys, Calif.

► **General Precision Inc.**, Dallas, Texas, \$1.5 million from Flight 54th Co., Inc. for flight simulator for the Grumman Catfish.

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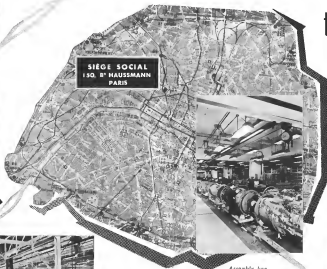


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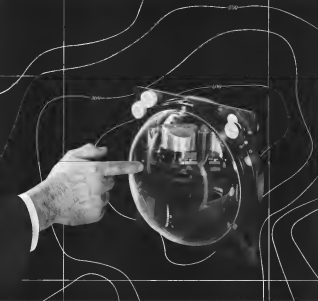


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and formerly of California: "One of the most important reasons I came was the knowledge that I could continue my education as I worked. And once I arrived in Minneapolis I was happy to find that not only was the University of Minnesota only ten minutes away, but Honeywell also encouraged me to go on with my schooling as a tuition reimbursement benefit. Another reason was the small work groups. You don't feel like a number!"



John Brewer, Senior Development Engineer,

born in Minnesota, and recently from Los Angeles: "For one thing, my family moved the four seasons we have out here... but more importantly, I suppose, was the fact that I wanted to work for a company I knew was foremost in controls in the U.S., and I wanted to have some control over what I designed and developed. To stick with a project from start to finish—to nurse it along—this Honeywell wants me to do."



What does Honeywell have to offer me?

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Wright/Sperry



Temperature Compensated Servo Motor Tachometers

New available are servo motor tachometers which operate reliably over a wide ambient temperature range. For example, from 0°C. to 85°C., this ST-10 will maintain a speed sensitive voltage to within 0.5%, a phase shift to within 1°, and a tachometer linearity of 0.05% from 0 to 3600 rpm.

Write for Data Sheet ST-673

WRIGHT MAKING COMPANY
Division of Sperry Rand
Durham, North Carolina
Telephone 682-8161

NEW AEROSPACE PRODUCTS

Missile Gyro

Device, designated "Gyro 14," has been developed for use in guidance systems of medium- and short-range tactical missiles.

Gyro is 5 in. long and only slightly more than 2 in. in diameter, weighing less than one pound. Turbine-type gyro wheel is actuated by a hot gas charge to an operating speed of 42,500 rpm in less than 500 milliseconds after ignition, according to the manufacturer.



At top speed, the gas nozzle rotates unidirectionally, and the gyro mechanism is engaged and ready for firing. Only one electrical signal is required to initiate the sequence, and no separate sensing signal is needed.

After 60 sec. of operation, the mechanism's angular velocity is rated at 50% of maximum. The 2-deg.-off-center gyro has preloads on both axes. One gyro can supply reference for a spin stabilized missile, and two can stabilize all three axes of a flying missile, the manufacturer reports.

Instrument Division, Lear, Inc., 110 Brewster Ave., N. W., Grand Rapids 2, Mich.



RPM Limit Warning System

System developed for turbine-powered Bell HU-1 helicopters is said to detect overruns and maintain gas limits of engines and rotor from the helicopter's cockpit and motor for loads a warning to the pilot by light and audio signals. The manufacturer reports that the

NEW FLEXIBLE PERMANENT SEALANT



For a threaded joint, just apply it on and off on to start. No pre-mixing or priming. RTV-102 silicone rubber adheres to almost everything—glass, metal, plastics, tile, wood, silicone rubber. Sets in minutes, cures in a few hours, forms a permanent sealant that never dries out, cracks or cracks. Resists moisture, gasoline, weathering, many solvents, and temperatures from -15° F. to 500° F.

RTV-102 won't slip on wetted surfaces, can be smoothed over finger, brush, "gun" with vibration and tamping. For true environmental sample plus technical data, write on your immediate descriptive label application to General Electric, 6600 General Products Department, General Electric Company, Watford, N.Y.

GENERAL ELECTRIC



pneumatic test stand for F-104 air conditioning system. Includes bleed air, pressure, and temperature controls.

Flight lab for the F-104 air-conditioning system

The Lockheed F-104 Starfighter's air-conditioning and pressurization system "flies" within this pneumatic test stand, designed and built by Hamilton Standard.

Two electrically driven 150-hp reciprocating compressors in the test stand simulate engine bleed air. This air, routed through aftercooler-water separator, surge tank, and furnace, is then supplied to the turbine fan and the test chamber. A 150-hp turbine compressor simulates ram air. Capacity: bleed air, 55 lb/min at 200 psig, 480°F; ram air, 130 lb/min at 6 psig, 490°F; pressure, up to 1 lb/min at 550 psig.

Building test stands of this type demands a

high degree of technical competence in systems engineering, electrical circuitry, pneumatics, hydraulics, electronics, and packaging. At Hamilton Standard, these capabilities are integrated with quality manufacturing.

Hamilton Standard has produced test stands for environment conditioning equipment, jet engine fuel controls, propellers, and a broad range of related aerospace systems and components. For the solution to your aircraft and missile test equipment problems, write: Sales Manager, Ground Support Equipment, Hamilton Standard Division of United Aircraft Corporation, Windsor Locks, Connecticut.

Hamilton Standard DIVISION OF UNITED AIRCRAFT CORPORATION

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AIRCRAFT & INDUSTRIAL ENGINE CONTROLS • ENVIRONMENT CONDITIONING SYSTEMS • GROUND SUPPORT EQUIPMENT • TURBINE STARTERS
SOLAR POWER GENERATORS • STATIC POWER SYSTEMS • AUTOMATIC STABILIZATION SYSTEMS • ELECTRON BEAM MACHINES • PROPULSION

system has applications in conventional aircraft as well as helicopters. The system also detects turbine governor failure, power train failure, and rotor over-speed or underspeed during autorotation. It also has provisions for predicting turbine compressor stall and governing engine rpm. The system is designed for full-rate operation and has a power drain of 4 amps at 28 v d.c. Bell Helicopter Co., P. O. Box 457, Ft. Worth 1, Tex.

Space Simulation Chamber

Chamber designed for aerospace research and development operations is 8 ft. long and 5 ft. in diameter with a volume of 100 cu. ft.



The chamber includes a pumping system and controls for operation in the 1 x 10⁻⁶ Torr range. The simulation tests the device can reach a pressure of 5 x 10⁻⁷ Torr in 40 hours or less. Chamber can be fully opened at one end by a hinged, lock-down, dog-breed door. The chamber has 11 remote view ports and five air feed-through ports. Pumping system has a 12,000 liter per sec. diffusion pump, and a 32-in. dia. compressor is included for addition of another pump to upgrade the system.

Liquid nitrogen-cooled heat sink provides a cylindrical tank, envelope 7 ft. in diameter and 8 ft. long. Heat sink is designed for operation from ambient temperature to -100°F.

Chicago Bridge & Iron Co., 901 W. 34th St., Oak Brook, Ill.

Solar Simulator

Portable simulation device is designed for use in laboratories and research centers to duplicate the sun's radiant energy at the edge of the earth's atmosphere.

Simulator uses vacuum deposited interference filter and two lamps, one xenon and one tungsten, which can illuminate an area of 70 sq. m. with full sun intensity. The device operates at a power output of 1 kw.

Optical Coating Laboratories, Inc., 2789 Giffen Ave., Santa Rosa, Calif.

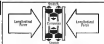
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Compact

EDGEWATER RING SPRINGS HIGH CAPACITY IN SMALL SPACE

Great capacity to absorb shock or vibration in a smaller space is made possible by the unique design of Edgewater Ring Springs. The smallest standard size—less than one inch diameter—absorbs axial forces up to 3190 pounds. The largest—19 1/2 inches diameter—will take almost a million and a half pounds force. A great variety of springs can be made within this enormous and maneuverable size.

The drawing below shows how the tensile and compression strengths of steel are used to provide a uniform, predictable spring for each unit. An important characteristic of Edgewater Ring Springs is the damping effect. Friction, inherent in a ring spring, effectively dampens resonant oscillations and harmonic vibrations.



Shows ring spring design. Note: Axial force can be increased by using a smaller diameter.

Write for additional engineering information regarding applications, loading characteristics, particular travel, space limitations, and other pertinent information.

EDGEWATER STEEL COMPANY
P. O. BOX 470 • DEPT. A.N. • PITTSBURGH 30, PA.





HOW TO MAP THE MOON

An electronic imaging system designed by Fairchild can survey the lunar surface with resolutions up to one meter. Charts of this precision can help our first moon explorers locate themselves with pinpoint accuracy. But how to make them? Fairchild studied the problem in depth, designed a system that can acquire terrain data from a lunar satellite, receive and process the data on earth, then convert it to highly detailed maps. The system can also provide high resolution photos of potential landing sites.

Advanced systems like this illustrate Fairchild's unique combination of capabilities in electronics, photography and in cartographic and data processing technologies. Other examples are outlined in a brochure, "Facilities and Capabilities—An Eye to the Future." For your copy, write Dept. 13, 750 Bloomfield Ave., Clifton, N.J.



DEFENSE PRODUCTS DIVISION
ROCKET, N.Y./CLIFTON, N.J.
LOS ANGELES, CALIF./PALO ALTO, CALIF.

A COMPLETE VISUAL IMAGING SYSTEMS CAPABILITY

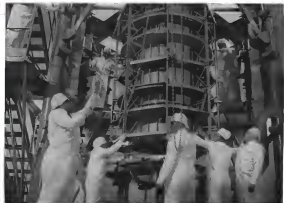


Encasement over chamber (left) at Grumman Aircraft Engineering Corp. is used to simulate various conditions up to 200 mil. altitude in testing the Orbiting Astronomical Observatory (OAO). Echo 2 astronomical satellite's reaction assembly (right) is shown mounted on shaker table in Grumman space simulation center. All facilities shown are at the Bethpage, N.Y., plant.



Grumman Tests OAO, Echo 2 Satellite Assemblies

Grumman technicians prepare structural test model of the OAO satellite for testing in the clean room at the company's space simulation center (see cover). Satellite is scheduled for launch in late 1968 into 185-min. circular orbit at 500 m.m. altitude to measure precisely the entire orbital field. OAO will weigh 1.5 ton, harvest U.S. satellite designed to date.



AEI Unit Designed to Operate Continuously for 3 Years Without Additional Lubrication or Adjustment

Here's 2100 lbs of fail-proof 400 cycle power for ground support, designed and manufactured by the motor generator experts of American Electronics, Inc. This motor-generator was developed for The Boeing Company for use at Minuteman load sites. Though detailed performance data are under wraps, certain general characteristics of this new AEI unit are worthy of note.

Designed to Perform Even If Outside Power Fails

This all in one motor-generator drives current from the regular power line; its AC-DC motor-generator delivers continuous 400-cycle power for the needs of the application. But integrated into the unit is an emergency DC motor powered by batteries. If the outside power source fails, the DC motor cuts in automatically—takes over immediately and continues to drive the generator.

Designed for 3 Years of Continuous Duty with No Down-time!

AEI's reliable design featuring an alternator with brushes or slip rings, delivers outstanding performance under the most stringent conditions. The unit was designed for continuous operation over a 3 year period—without maintenance, without downtime. Shock tests demonstrated it has a capability of withstanding extremely high "g's" while running under full load—which is no small point in favor of a unit to be used in the national defense.

AEI

**MOTOR-GENERATOR
DELIVERS
3 YEARS OF
FAIL-PROOF
POWER
AT THE
BOTTOM
OF THE
MINUTEMAN SILO**



AEI

AMERICAN ELECTRONICS, INC.
FULLERTON, CALIFORNIA

AEI Know How Means Reliable Performance

The special motor-generator unit described here is very special, indeed—both in application and function. But it shares a common characteristic with all other AEI motor generators—and with all the products made by AEI. That common denominator is reliability. Since its inception, AEI has been building equipment both land and deep in rotary equipment and associated sub systems. AEI's Rotary Power products rank the prime from high frequency power supplies to high speed turbine powered generators. Prime contractors, industry and the military count on these and all AEI products for top reliability.

AEI Thinks Ahead to the Future of Aerospace

AEI design engineers have been responsible for practical advances in a variety of products for aerospace. Continuing R & D programs insure that more such advances will be forthcoming. Most of the nation's missile and satellite projects now employ one or more AEI products. AEI can supply your needs, too. For a picture of AEI services, write for our comprehensive brochure.

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Fresh ideas are always welcome at AEI. Qualified engineers who would like to expand into a new environment are invited to write, too.

Address inquiries to American Electronics, Inc., Dept. AE-662, 12541 East Ross Ave., Fullerton, Calif. Telephone TR 9391 3300 TWX: FUL, CAL 3115 • WUX



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Rich in experience, ASTEK says more pleasure in the development of many of today's standard air and space instruments and systems. ASTEK is now working on new advanced projects that will significantly contribute to the routine operation of advanced aircraft, missiles and space vehicles.

**ASTEK
INSTRUMENT CORP.**
ARMONK, NEW YORK



PRODUCTION BRIEFING

Avco Corp.'s Licensing Division, Southfield, Conn., will produce Mark I-10000 vehicles for the Minuteman ICBM under a \$6.1-million contract from USAF's Ballistic Systems Division.

The Garrett Corp.'s Aircrafts Mill Division, Phoenix, Ariz., has received a \$270,000 contract from Alamosa later national Division of North American Aviation, Inc., to develop power concentrator components for the Super Phoenix for Nuclear Aircraft Power program.

General Electric Missile and Space Vehicle Department will produce rocket motor cases for the Avco's Team 2 ICBM under a \$16.75-million contract from Ballistic Systems Division.

Magg Sonosack, Inc., will produce electrolytic drive servos for the Navy's Taurus Torpedo under a \$900,000 contract from General Dynamics/Phonics.

King-Tecno-Vought has received a \$1.10-million contract from the Army to produce launchers for the Sergeant surface-to-surface missile.

General Construction Co., Pasadena, Fla., will modify the Saturn booster static test tower at NASA's Marshall Space Flight Center under a \$500,000 contract. Work will consist of adding the west side of the tower to accommodate tests of the Saturn C-1 booster.

General Dynamics/General will fabricate and test a titanium component needed for use in supersonic aircraft missiles or space vehicles under a \$75,000 contract from USAF's Aeronautical Systems Division. General Dynamics will select the part, which will be of general design and configuration, such as a fuselage frame or bulkhead, to be applicable in advanced aircraft or spacecraft. Test process will simulate critical combinations of loads and temperatures up to 1,800° which would be encountered by advanced space vehicles.

Stocky ISS-2 two-barrel helicopter has been selected by the Japanese Defense Agency for use in that nation's anti-submarine warfare operations. An initial order of 11 helicopters is planned as a result of negotiations carried out by United Aircraft Corp., Salisbury, Mass., through Mitsubishi Heavy Industries (Tokyo), Ltd., Japanese licensee for manufacture and sale of the ISS-2.

JACK & HEINZ



AT VOLTAGE REGULATOR

The Jack & Heinz 51158 A-G Voltage Regulator is a monolithic transistor magnetic amplifier, 3 phase average sensing type regulator designed for a mobile application. Of single deck construction, all external electrical connections are into the rear mounted 51158. Circuit connections are (all pins) — joined with ERSA 5 Core Solder—making the high reliability degree of reliability is superior.



ERSA Multicore 5 Core Solder costs Jack & Heinz a trifle more than ordinary solders—but this is more than compensated for by the vital savings realized through more joints per person, and virtually no costly rejects due to cold or 8-15 years for production efficiency, gain tested by 5 cores of exclusive ERSA flux and fast melting thermal construction, quickly manufacturers have come to rely on ERSA Multicore, the world's finest bond solder.

Multicore is covered under all applicable Patent Specifications. For information write: Jack & Heinz, 801 22nd St., New York, N.Y. 10011.

ERSA
Multicore
5-CORE SOLDER

MULTICORE SOLDER CORPORATION
PORT WASHINGTON • NEW YORK



French air force Dassault Mirage 4A to export bomber takes off with wing fuel tanks.



Mirage 4A is powered by two SNECMA Atar 9 turbojets, can be modified to serve as bomber. Photo shows auxiliary fuel tank under fuselage.

Mirage 4A Carries Wing Tanks; USAF Tests Mirage 3C

Photo below shows comparative size and design similarity of Mirage 3B reconnaissance fighter (left) and Mirage 4A bomber.



Dassault Mirage 1C fighter intercepts is shown retracting landing gear shortly after takeoff. Aircraft is powered by SNECMA Atar 9B turbojet delivering 11,215 lb. thrust with afterburner. Initial deliveries of aircraft to French air force began this year.

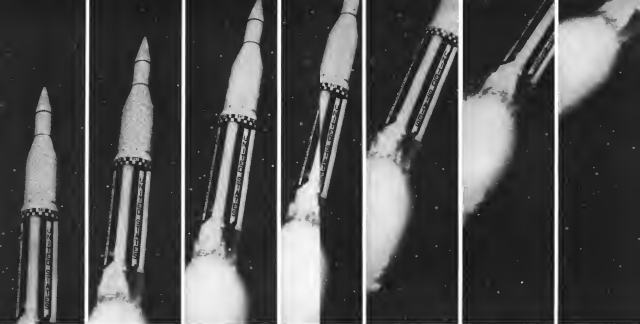


U. S. Air Force pilot takes off in Mirage 1C carrying under fuselage external fuel tank. Besides French air force, Dassault has sold the plane to Israel, Switzerland, Australia and Republic of South Africa. Ground support fighters and reconnaissance versions have also been developed, the former incorporating Doppler radar for all-weather capability.



Mirage 1C is shown above with auxiliary fuel tanks slung under the wings. Below, USAF test pilot, one of three who evaluated the aircraft and its associated weapon systems displays a maneuver involving parachute immediately after takeoff.





TARGET INSTINCT...

Eclipse Pioneer advanced inertial guidance systems give missiles, boosters and space vehicles warning "target instinct" whatever the mission. Proof?

Take the Pershing, Army's "shoot and scoot" missile. Flight tests have demonstrated the flawless accuracy of the inertial guidance system—built by E-P—which utilizes our ultra sensitive air bearing gyros and accelerometers. Performance

has continually exceeded project specifications. And precision has been consistently ahead of schedule.

Take the Saturn C-1, NASA's super-rocket earmarked for manned space flight. E-P has been selected to build the highly complex guidance platform because of our knowledge in space age techniques and our proven success on the Pershing missile.

BUILT IN!

Intensiveness, imagination and experience play key roles in Eclipse Pioneer's ability to solve the difficult and complicated problems associated with the assurance of inertial guidance. When it comes to state-of-the-art in manufacturing techniques, E-P takes the lead. For example, tolerances of 10 millionths of an inch and one second of arc are constantly maintained in our own Beryllium production machining

facility. From initial design to complete system manufacture and test, our facilities and capabilities are backed by over forty years' experience in developing and producing the world's most advanced systems for flight control and airborne navigation.

Our technical sales staff invites discussion of your guidance and control requirements. Call us in Teterboro, N. J.

Eclipse-Pioneer Division



WHERE IDEAS
UNLOCK
THE FUTURE



SPERRY

An operating mode of Magloc I—a new logic computer employing advanced magnetic techniques for maximum reliability—will soon be delivered to Armstrong Siddeley Division, Air Force Systems Command, USAF. Its reliability target is 14,000 hours mean-time-between-failure, under extremes of environment.

Developed by Sperry under ASD sponsorship, Magloc I uses the high reliability inherent in semi-active magnetic components for its logic, drive and memory circuits. Extensive design study and test breadboarding have resulted in a significant reduction in the number of failure-prone semiconductor components such as transistors and diodes... in a replacement of those components by magnetic components... and in an overall reduction

of total components.

For example, the active components required in a 24-stage shift register was reduced by a ratio of 24-to-1, and the total component count by ratio of 9-to-1. Uniquely, high-density, encapsulated welded packaging—using functional building block techniques—further enhances the ultimate reliability of the new logic computer.

Magloc I features a bipolar core non-destructive readout, and electrically-erasable, program memory operating from -55°C to 125°C without compensation. Effective clock rate is 300 kc. Designed for long-duration interplanetary missions, Magloc I offers distinct advantages in cost, size, weight, and reduction in maintenance. Inquiries are invited.



MAIN FUSelage AND the British Aircraft Corp. BAC 111 transport are on the production line at Vickers-Armstrong's plant. BAC 111 will be built on the Vickers production line at the factory. Long-range version of the BAC 111 will have a 1,000-pd. fuel tank added to the centre fuselage section for British Overseas Airways.

British Push BAC 111 Service Program

By Herbert J. Coleman

London—British Aircraft Corp., now well advanced in logistics of building its BAC 111 transport, Vickers-Armstrong, in four widely separated plants, has turned to concentration on building up a support and sales and service program in strategic world areas.

Metrol for the airplane now is being cut at Vickers-Armstrong's plants at Weybridge and Here, Hunting Aircraft at Luton, and Bristol Aircraft, at Filton. Final assembly will be at Filton. Strong sales backup, aimed strongly at the U. S. market for potential sales prospects, is being developed by British Aircraft Corp. in conjunction with its companies Hawker Siddeley Aviation, using Societe of British Aircraft Co. aircraft standards as a guideline.

Service is desired mostly at strategic bases of components in Britain, long a sort spot with airlines and engine manufacturers because of lack of an over-all quality control plan. Airlines, in particular, have been critical of overseas service organizations involving groundings to wait for replacement parts.

Rules for standardization currently are being formulated by a 50-Mc. task force subcommittee. As part of the long range planning plan which will result BAC has decided to offer a repair warranty on the BAC 111 instead of the seven-year warranty offered on previous transports, such as the Vickers Viscount.

Comparison experts note the BAC 111 will be certified by the success of



COCKPIT HOOKUP of BAC 111 at Luton is based on Bristol Airways production for two pilot operation. Engine instruments are centered, with right yoke in left seat and left yoke in right seat. White lighting is used.

**Major advance in cryogenic
cooling**

**Miniature
turboexpander
Increases
closed cycle
system
reliability**

*Actual size turbine wheel for 250,000 rpm, gas lubricated
turboexpander in AResearch closed cycle systems*

Garrett-AResearch is completing development work on closed cycle nitrogen helium and neon systems using a tiny turboexpander as the drive of a piston expander.

This promises to dramatically increase system reliability and service life because all wearing surfaces, valves and transmission processing loads have been eliminated. These compact, lightweight systems for lasers, parametric amplifiers, RF cell cooling and computer equipments are ideally suited to commercial applications as well as military ground and aerospace uses.

AResearch was first in production work as open cycle IR cooling systems, and has already produced a closed cycle refrigeration system. The company is now working on military programs for 30°K and 4.2°K closed cycle systems.

Using its experience as a world leader in lightweight helium/hydrogen and cryogenic cooling, AResearch is also developing an all-turboexpander closed cycle system incorporating a turbocompressor as well as turboexpander.

Your inquiry is invited.

AIRESEARCH MANUFACTURING DIVISIONS • Los Angeles, CA, Calhoun • Phoenix, Arizona
Systems and Components for:
Aircraft, Missiles, Spacecraft, Electronics, Nuclear and Industrial Applications

1964, with first flight pegged at next April.

Development cycle that would be about three and one-half years from conception to delivery to customers in late 1964.

Project runs roughly at 2,000 per year, and is under the overall direction of W. Arthur Summers, managing director of Hunting Aircraft.

Hunting's Luton plant is responsible for the BAC 111's wing design and construction.

Production Doubled

Summers said a production batch of 20 aircraft was the original intent, but that that figure has been doubled in a corporate gesture of confidence in future sales. Then BAC 111s have been ordered by British United Airways, British International has ordered an and eight are for an operator who does not wish to be identified, but reportedly is buying the eight aircraft as a broker.

Summers said that about 50% of the manufacturing drawings have been issued to production firms, about 20,000 will be needed for the entire project. All major tools and jigs are completed and test rigs are under construction. Electric models for wind tunnel testing have been built, at a cost of about \$100,000 and company is making \$300 for all tunnel testing, producing 15,000 data points.

Main airframe stress tests will start at the end of this year with 1,500 gpm sanding stress levels. Fatigue testing is planned for equivalent of 100,000 flights of average flight time of 40 min. Summers predicts a fatigue life of 50,000 hr per aircraft and added the six air fatigue programs will take about two years to complete.

Landing gear will be tested separately, primarily due to a history of gear-cowling troubles associated with jets on air.

Ground Time Cut

Major portion of design time has been spent on reducing ground time to a minimum, according to A. J. K. Cairns, Hunting chief designer who was involved in design of the Hunting 167 predecessor of the BAC 111.

For instance, Cairns pointed out the following:

• Hydraulic system for both front and rear landing gear is provided to customer requirement.

• AResearch's auxiliary power unit is mounted on the tail cone, far well as usual main engine driving ground electrical power and ground cooling of cockpit and passenger cabin. AResearch APU was selected because the Garrett division could generate correct backup. Cairns said integrated APU also improves payload capability by eliminating



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Is permanently out...**

with Sylvania's Visual Glide Slope Indicator

Here's the remarkable new lighting system that makes landings safer and easier than ever before. It's the Sylvania Visual Glide Slope Indicator. Now being installed at major metropolitan airports. Veterans pilots praise it. Here's how it works.

When a pilot comes in too high, he sees a double bank of white lights on either side of the runway. When he comes in too low, he sees a double bank of red lights. When he comes in just right, on the correct glide slope, he sees one bank of red and one bank of white. It's a major advance in airport safety, and it's ready to work for you now. Conforms to applicable FAA and military specifications.

Whatever your airport lighting problems, Sylvania has the lighting system and technical assistance to solve it. For information write to Special Products Division, Sylvania Electric Products Inc., Erie Street, Ipswich, Mass.

SYLVANIA
MULTI-PURPOSE
GENERAL TELEPHONE & ELECTRONICS



COMMAND AND CONTROL

The nation's deterrent posture is based on a tightly controlled retaliatory force capable of immediate action through the proper commands. The survivability of the command and control structure and the security of its communications are vital elements in overall national defense.

The design of such a command and control system demands consideration of the politico-military structure, and of the deployment and use of a wide variety of weapons systems of overwhelming power. To this must be added a proven capability in modern electronic technology.

Raytheon's Missile and Space Division has developed truly unique concepts by applying an integrated "weapon system" approach to the command and control problem. Raytheon is applying these concepts to the problems of survivable national communications, as well as control of strategic aircraft and missiles, mobile ballistic missile systems, and field army weapons.

Engineers and scientists interested in these vital and challenging areas are invited to contact Mr. W. F. O'Malla, Raytheon Company, Missile and Space Division, Bedford, Massachusetts.

RAYTHEON COMPANY

RAYTHEON

MISSILE AND SPACE DIVISION

need for bleed tanks from the two Rolls-Royce Spey engines.

- **Single-point refueling** at 300 gpm, rate takes 74 min to complete. Auto-rotate instead for bleed tanks will be installed.
- **Single servicing point** for domestic water supply and external servicing of toilets.
- **Low-loading of baggage compartments**, both fore and aft. Sliding freight doors form a ledge to assist baggage loading.
- **Large capacity wheel brakes** designed for 15,000 manuevers without out-braking. Carline and brakes have twice the inertia energy absorption as those installed on the Vauxhall Interceptor concept.

Duplicate Systems

Eight LAR-100 hydraulic systems for control controls, such as flaps and landing, hydraulic lines and valves and fuel units, along with duplications of sources of power. Two hydraulic systems are independent of each other and both include an electrically powered backup to the engine-driven hydraulic pump.

In case of complete power failure the BAC 111 can be flown safely as manual controls and steering, with sufficient freedom to operate the rubber manually for landing. Gate may be lowered by gravity after manually releasing the uplocks.

Electrical system also is duplicated; in the event of complete loss of main electrical power, two 25 amp batteries provide power for at least 45 min. for essential services.

Three Spins

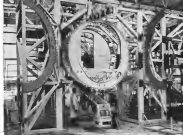
Carline explained that, on fat-side philosophy, wing has three spins and the fuselage has continuous frames and struts, with fuselage divided dorsally to the spar. This provides a cross section of 9,500 lb/in. Fuselage structure will use only copper-based aluminum alloys in order to obtain high fatigue-resistant properties.

There are no sub-busbars used in BAC 111 construction. In addition, Carline said there will be no high grade steels used in landing gear design, because of difficulties experienced with the larger jet transports.

To facilitate maintenance, Spey engines pods have large doors for engine removal.

Thus, it is not necessary to disassemble the pod mounted for detection system during a change. AF 800 has the engines also have self-sealing couplings.

At Vickers-Armstrong's' Weybridge plant, work is concentrated on machining wing skins and fuselage panels, the wing center section and landing gear. Customer mockup, which has been re-



NEAR FUSelage of BAC 111 is built in this jig at Bristol Aircraft plant at Filton.



ROLLS ROYCE SPEY bypass jet engine for BAC 111, at Hatfield Turbine and Division. Recreometer used in the engine is built at the Derby factory.

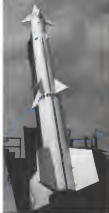


STRUCTURAL MILLING MACHINE at Weybridge cuts half of form fuselage side panel with integral struts. Window openings are milled out later.

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- For complete information** on Avco's space communications capabilities, write Director of Marketing, Electronics and Ordnance Division, Avco Corporation, Cincinnati 41.0800.

This Aero
Servitide Command
Receiver and
Video Detector
package will collect
and control all
equipment aboard
NASA's Orbiting
Astronomical
Observatory.



Fifth Nike Zeus anti-ICBM missile being at Ft. Meigs was considered a partial success, although it failed to hit tape-record target and to intercept computer. Missile was automatically destroyed before third stage motor ignited.

Largest section for shipment to Harnsail assembly line is the rear fuselage and tail fin, now being built at Bristol Aircraft. Fifth unit is on the way and will be shipped by road to Harns after completion.

Ballo-Rocket Spy engines are going through an Air Force testing program and are in the de Havilland Tornado three jet transport program of 2,000 by engine manufacturers testing, using the Tornado, will start in June, individual engines will be taken up to 750 lb. thrust between October 80. So far, the Spy has accumulated more than 2,500 lb. of bench testing.

Protect Vital Assemblies, Assure Safe, Trouble-Free Operation



Increased adiposity and peripheral lipids in diabetic exposed subjects—any effectively pure insulin therapy is either better resulting in an increasing of insulin and not



Shin's argument that I, as a young "punk" cannot take pride in the entire nation's war-torn ruins is, paradoxically, identical to the one I, as a young American, might make about the ruins of Hiroshima.



For maximum reliability, users can be provided with a checklist of symptoms that likely precedes all cases of an outbreak.



But little by a 3.5% decline, that shows how extremely he managed a company... said he thought that they were well running a few divisions as well as other same.

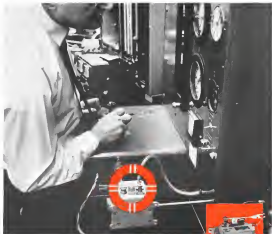


Wierzbicki, Dorota

Townsend Company

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Barbara T. Tjebke • Brooklyn, Connecticut • June 2010 • 2160 • 1991-1992 • 1993
 Eric Weiler • St. Paul, Minnesota • June 2010 • 2160 • 1991-1992 • 1993



The **LIFEGUARD** of the future on schedule today at SCOTT

Passenger safety is a never-ending challenge at Scott. This Automatic Passenger Oxygen Flow Control Unit (Composite Regulator), undergoing exhaustive tests at Scott research laboratories, has been selected as standard equipment on the Boeing 737 jet. It automatically activates and controls oxygen flow to the passenger emergency oxygen system, replacing as many as seven previously required components including pressure reduction, automatic turn-on and altitude flow control, activation surge, and turn-off.

The new Scott Composite Regulator is automatically actuated at cabin altitudes of approximately 14,500 feet, and turns off again automatically at cabin altitudes of between 8,000 and 10,000 feet. The unit can be manually reset to "off" position at any altitude in between, while still retaining the auto-

matic features. As an added safety feature, the Regulator supplies a supplementary surge immediately after activation of approximately 80 psi, lasting about 10 seconds. This assures adequate filling and pressurization of the distribution system and positive activation of mask presentation devices. After this initial surge, pressure is maintained at required levels, automatically controlled in response to system flow requirements and changing cabin pressure.

In addition to its many versatile features, the Scott Composite Regulator offers significant advantages in reduced weight, better efficiency, lower maintenance costs, and increased configuration flexibility.

For more information on the Scott Composite Regulator and how it can help you solve aerospace design and engineering problems write, phone, or wire:



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Export Sales Office Company 2 West 57th Street New York 11 New York West Coast Office
15117 Pines Rd., Chino, Calif. Scott Sales Office The White House Company, Ltd.

when its standing in the unrelated industry. Decision making, procurement of resources, including labor, equipment and contract bidding. Needs are in the form of financial and operating reports, contract awards and new job goals to be had. Research and development contracts are funded on a cost plus fixed fee basis and production is done on a fixed price. Space systems and service systems are treated as separate product lines.

During a grace term members have the opportunity to evaluate the future and the associated contractors who relationships that must be maintained to produce success. For example, improved facilities, rational research and exploratory testing tend to reduce productivity of the company but can be obtained only at a certain increase in the cost of operation. As time passes, however, contract awards are influenced by other factors such as bid price, cost performance, etc., they can decide whether to accept the increased cost of additional productivity or use the money so as to make a correspondingly lower bid.

Some Factors Revised

The revision of ARDS in the LMSC information processing staff have revised some factors in the simulator model on the lower performance routine. Among the revisions were reduction of the weighting assigned to availability of resources and the methods of comparison. Research condition in factors in determining contract awards.

Fast games show that experienced teams make individual decisions within a framework of basic policies that express the degree of risk the team is willing to assume and the effectiveness of short-range project team language project.

Typical risk considerations are the amount of backup to be maintained and the degree of diversification to be sought. High holding in resources against increasing cost of work, but requires that the response had more directly because it is a go-around policy to maintain some sort of balance in the award of contracts to keep competition in the field.

The game design represents an evolutionary blend between R&D work which is funded by cost-plus-fixed fee contracts and production which is funded by fixed-price contracts. Operations are also divided along product lines into specific systems and space operations. If a company specializes in one function or product line, it can become more efficient in that area but run the risk that a contract in that area might not be available when the company needs business. Each team must also weigh the desirability of high contract profits against the gain in efficiency and

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SN Speed Increaser units have been engineered to both over speed test equipment and mechanical applications. Capable to 1000 RPM and to adapt speeds to 10,000 RPM are available in case to designed to your specification.



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PROBLEMATICAL RECREATIONS 123



Find a two digit number whose first two digits cannot add, and last two digits are perfect squares and whose square root is a prime polynomial.

—Continued

Did you know that Lagoon Diversions includes such exotic organizations as the Danke Specialty Printing Company and the Secret Admittance Company? We mention some to give you some indication of our diverse specialties. Other Lagoon members are: A. Kuchel & Company, Cole Steel Engineering Company, Army Service, and the Capital Shipbuilding Corporation. We're sure you already know about our Monitor Calculating Machine Company so we won't push our point. Lagoon activities and products cover the industrial-electronic-military scene.

ANSWER TO LAST WEEK'S PROBLEM: The equation $1/3 + 2M/3 + 8 = 10$ had the solution $M = 30$. In other words, Mary is as old as the Nile.

LITTON INDUSTRIES, INC.
Beverly Hills, California

Kearfoot package series contain all component elements, transmitters, motor generators, amplifiers, etc. of typical positioning systems. Available in two basic versions: BuDed configuration with output shaft, and flat pack in-line configuration without shaft. Transmitted amplifier can be built into either Buod size 13 (with two size 5 components), size 15 (with up to four size 5 components), and size 18 (with up to six size 5 components). Flat pack type accommodates up to four wound components. Component complement and precision gearing in a wide range of ratios — to your specifications.

For complete data write Kierulff Division, General Precision, Inc., Little Falls, New Jersey.

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Resistant to high shock, vibration, and temperature extremes. Applications include altitude, longitude, azimuth, or conventional regular shaft displacement conversion and decimal/cent conversion. Norrist's exclusive drum design gives large conversion capacity (typical unit 2³¹ is small size). Combustible counter-converter assemblies for visual and electrical readout also available.

CHARACTERISTICS:					
Part Number	PS-200 11A	PS-200 11A	PS-200 11A	PS-200 11A	PS-200 11A
Year	1964	1964	1964	1964	1964
Site - 1000	1000	1000	1000	1000	1000
Range	0-1000	0-1000	0-1000	0-1000	0-1000
File path: 1000000 10	1000	1000	1000	1000	1000
Result: 1000 10	1000	1000	1000	1000	1000

For complete data write Kearlott Division, General Precision, Inc., Little Falls, New Jersey.

GENERAL PRECISION

FINANCIAL

Four Airlines Report Salaries of Officers

Washington—Following is a list of airline officers' salaries, bonuses and indirect compensation, expenses and stock holdings for the year ending Dec. 31, 1961, as reported to the Civil Aeronautics Board.

[illegible][illegible][illegible][illegible]

North Central Airway Inc.—E. H. Cramer, president and director; \$16,000 salary, 1987 bonus and health insurance; 14,343 shares; 1987 income tax return shows earnings are \$1,345,000. **E. S. Shadler**, vice president traffic and sales; \$14,700 salary; 10,000 shares; 1987 income tax return shows earnings are \$1,345,000. **R. H. Dwyer**, vice president; limited liability interest; \$12,000 salary; 10,000 shares; 1987 income tax return shows earnings are \$1,345,000.

114,700 shares; 1116 shares; 10 million shares of common stock; A. B. Sweeney the president; 100 shares; 115,000 shares; 1114 shares; 100 shares of common stock; B. Ward the president and treasurer; 117, 100 shares; 1430 shares; 11420 shares of common stock; J. F. Shaw secretary; 10 000 shares; 1710 shares; 10 shares of common

1. E. A. Knaflitz, chairman of the board 107 0th street, 2000 Leavenworth and railroad construction \$11,000,000, 1,100,000 shares of common stock 1,100,000 shares of common stock in the name of others.

W. E. Thompson, **ASSISTANT CONTROLLER** and **director**, \$5,000 salary, 1980 bonus and indirect compensation, \$311 expense, 30,548 shares of common stock. **F. E. McCarroll**, **area controller** and **director**, \$7,450 salary, 1980 bonus and indirect compensation, \$273 expense, 34,190 shares of common stock. **W. E. Welling**, **director**, also bonus and indirect compensation, \$112 expense, \$9.25

shares of common stock. A. E. NEWELL, who controlled plaintiff, owned and directed 551 2/3 shares, \$448 bonus and interest compensation; \$14 5/7 payments; 578 shares of common stock. A. J. Mandler, director (March-April 1982), 2889 bonus and interest compensation; \$141 payments; (1982) shares of common stock. G. R. Crocker, director (March-April 1982), 5600 bonus

The following firms have sold 40,000 or more for services rendered during 1981:

Elan-Yan, Fremont, Ontario, 1-800-922-7221	Ray & Ray, International Information Systems, 4175, Maryland Avenue N.E., Suite 400, Denver, 1-800-762-8888
Elan-Yan, Fremont, Ontario, 1-800-922-7221	Ray & Ray, International Information Systems, 4175, Maryland Avenue N.E., Suite 400, Denver, 1-800-762-8888
Elan-Yan, Fremont, Ontario, 1-800-922-7221	Ray & Ray, International Information Systems, 4175, Maryland Avenue N.E., Suite 400, Denver, 1-800-762-8888

Small Power Stations Unit—A. Big, grand-
dams and diverters 251 000 salary 14 000
expenses 10 000; shares of common stock
127 000 (dividends) 20 000; via stock-
holders 114 000 salary 1400 expenses 474
shares of common stock 40 000 returned
to via dividends 110 000 salary 12 000
expenses 10 000 shares of common stock
20 000
T. E. French, 102 000 salary 17 000 ex-
penses 300 shares of common stock 40 000
shares of common stock 110 000 salary 10 000
expenses 10 000

[illegible][illegible]

The following firms were paid \$100 or more for services rendered during 1961:

Albright Reed & Co., auditing services and various tax preparations, \$14,485.	C. Edmund Lenzner, legal services, \$11,373.
Washington Employees Inc., letter removal, \$10,151.	Charles George Dean, education & counseling, \$10,000.
James H. Rose, legal services, \$2,250.	

Grandfathered shares—A. H. Williams Inc. president, \$11,456 salary, \$1,637 gratuity, 11,560 shares of common stock. B. & K. Williams, 1000 paid-off dividends and salary, \$11,100 salary, \$116 expenses, 1,662 shares of common stock. F. C. Lowenthal vice president, compensating \$11,560 salary, 145 expenses, 345 shares of common stock. F. & W. H. Williams, president, \$11,100 salary, \$111 expenses, 155 shares of common stock. A. H. Brown,

common currency. **Chair** Dec. 22, 2011:
 \$11,590 salary; \$1,840 expenses. The share
 of common stock. **J. A. Haskins**, very pro-
 duce teacher, **Jan. 21, 2011**: \$10,117
 salary; \$115 expenses; 30 shares of com-
 mon stock. **H. E. Kellogg** (teacher) substi-
 tuted in the previous year: **Jan. 31, 2012**:
 \$10,150 salary; \$1120 expenses; 545 shares
 of common stock. **E. E. McKinnon**, very
 productive in the previous year: **Jan. 31**
 2011: \$11,790 salary; 5000 shares; 545

[illegible]

Clark, Alan & Clark, Inc./services, 312110,
Engers & Smith, servicing, 318 931,
Evans, Walter, advertising, 312 947, Frat.
Mortgage, Nathan & Co., roofing, 31 208,
Vernoy & Bartholomew, 312 107500,
Air Transport Area, various services,
311 550.



Precise, lightweight, high-accuracy components with applications in sealing computers and automatic control systems. The compensator winding provides feedback voltage for a nuclear isolation amplifier, the feedback loop automatically adjusts to compensate for temperature and frequency variations. Function error of the R980 D18 is only 0.1%. A compatible transistorized amplifier, Kearsch model 53500-03A, is available.

	Part Number	5000-41	CDS 5000-50 5000-04P
CHARACTERISTICS	Envelope (-50%) max.	40	20
	Frequency (kHz)	400	400
	Trans. Full Voltage (mV)	20	10
	Max. Error Pairs (E.P. transmits)	5	5
	Dist. from Trans. Range (C)	<55 ft <125	<55 ft <125

For complete data write: Kiewit Division, General Precision, Inc.,
Little Falls, New Jersey

These high performance units are designed to drive Kierulff's Size 11 RS60 winding-compensated speaker systems. The amplifier-resolver combination has stable gain characteristics and negligible phase shift through an ambient temperature range of -50°C to $+80^{\circ}\text{C}$. Extremely high resistance to shock and vibration. Most environmental requirements of MIL-88373.

Part Number	631 60-2
Input Impedance (100m resistive @ 25 °C)	4 to 20 channel
Output	300,000
Power	10 W 2000
Phase Shift Output (100m resistive @ 25 °C)	less than 25 mSec
Max. Signal Output Voltage	15 volts
Max. Signal Output Impedance (100m resistive @ 25 °C)	100 ohms

For complete data write Kearlitt Division, General Precision, Inc., Little Falls, New Jersey.



IMAGINATIVE
PACKAGING

Up to 363 standard parts on a 3-inch by 3-inch card with standard techniques

Electronic packaging engineers are perennially straight-jacketed with a multitude of system and functional constraints and then expected to enclose the several million parts of a complex electronic system into neat, logical, reliable, compact, efficient, economical, and readily producible and maintainable packages.

Littell packaging engineers drew just such an assignment when they were required to design packaging for a tactical digital data system to be installed in a carrier-based airborne early warning and control aircraft.

The constraints were: use standard parts, use standard techniques, achieve maximum productivity, confine system to a lesser volume of space than normally considered practicable, maintain flexibility required of a developmental system, and achieve better reliability than specified for volume electronics.

Despite these stringent constraints, Liffen packaging engineers successfully met all requirements. Most significantly, their efforts resulted in containing the system in half the weight and a quarter of the space of comparable systems.

Typical of the way in which packaging problems were resolved was the manner in which card-mounted digital outputs were handled. First, as an extensive study was made of parts density, card space, and interconnections. The over 2000 cards in the system were composed of 180 types. 1800 of these cards (covering



all 150 types) were designed to conform to a single standard grid pattern.

A square card (3" x 3") was selected for greatest loading efficiency. By edge-mounting the pads (winding them on card), decreases as high as 24% parts per card were attained. The pads were distributed according to a technique that afforded the highest possible volumetric efficiency as well as optimum pin efficiency. On each card, circuits requiring many input/output leads were combined with those using only a few. Instead of the conventional 4 flip-flop per card, for example, 5 flip-flops and some logic (gating were placed on a single card to avoid wasting logic on cards with several parts converting into a common connector were so placed that only a single lead was used. Parallel circuit parts were provided both on the card and through the connector to ensure reliability.

By these and other techniques, packaging of extremely high density and reliability was attained. Analog circuits, including gear trains and servos, were mounted on the same type of cards as the digital circuits to make possible one standard card design and tooling.

Why look about post engineering education? With voluntary and proprietary restrictions as they are, it's difficult to do otherwise. The point is, that now, and still is, pretty much package engineering. Later's new programs offer a host of extremely challenging problems that can be solved only through imagination-stretching, advanced electronic engineering. If such a climate appeals to you, write **Harry G. Loner, Lateral Systems, Inc., DDM Systems Division, 5706 Eton Avenue, Cerritos Park, California,** or telephone **DM-6440**.

4.5. Four Alternatives to Finance

Nicola, decaying, carbon $\text{C}_{\text{NII}}^{\text{dec}}$ ($\text{AG} 20037$)¹
 NDCOLA, Raper $\text{C}_{\text{NII}}^{\text{R}} 1021$ sub-report
 scaleless $\text{K} 080 \text{ km}^2$

SEEDY Roger 1817"
This was the last communication with the Secretary General's office.

Thus, the information given by air traffic controllers Miami, it appears that SEEDY never appeared reaching 8,000 feet. However, at 1230 Z on 060 state that at least Nubla lights to right and was marked Nubla, descending. At the same time it requested and received confirmation of the altimeter without (10000).

It may also be of some interest to note the changes of circumstances between the Nanda tower and GOCED, described as follows by air traffic controller Madan Chandra:

4,000 feet in GNTI from FL 75. The aircraft was required to speed climb to 4,000 feet. All this was achieved and was in fact above the stratosphere at 4,000 feet. It was instructed to maintain that height and to report NO air lights in sight. It reported lights in sight and was given the correct direction and strength, and cleared to enter the traffic circuit for runway 15."

It will be observed that OO-BMC, which was approaching from the west, after reporting standing 6,000 feet was asked to report its actual speed. The radio began to "light up" in light. It reported "lights on light" and went from green clearance to enter the traffic stream. The possibility was considered whether SE-BD11 in reporting "lights on light" should have been understood as being at 6,000 feet over the report. However, plausible that intercepts may be it does not seem to have been as understood by Mr. Vorne, who states that he had heard to the accuracy of 1719 feet. (Intercept evidence 6,000 feet)

Abstract Observed

[illegible]

*The info "A/D 318-411" indicates that the magnetic heading of Nakh from the aircraft was shown in the compass direction indicator (A/D 310) in the Nakh tower was 127° (magnetic). It would appear that the aircraft was not actually over the shifted NAC but overshooting the NACOM from the southeast, as might be expected if it had flown along the magnetic parallel.

Wanted: Men who cannot curb their curiosity



Working Space Laboratories is a new organization, open to fresh viewpoints and new ideas. Its greatest need now is for men like you: men with a driving urge to find out things for themselves. You'll help to point out the directions we'll go in the coming years ahead. Come in now and grow along with us. The following key open areas are immediately available:

Solid state physicists, to conduct fundamental research on many body problems as applied to an ultra high pressure program. The goals of this program are to study the electrical and physical behavior of materials under ultra high pressure; to investigate the origin, history and structure of the moon and planets, and to find ways to utilize their natural resources.

Scientists, to perform research in nuclear and radio chemistry, and to conceive and carry out investigations in the fields of activation analysis, dosimetry, gamma-ray spectrometry, surface phenomena, and numerous other areas.

Structural engineers, in do stress analysis and optimizes the design of advanced space structures.

A mathematician-physicist, to concentrate on systems analysis and operations research applied to military and non military space systems

Physicists experienced in electro optical imaging devices and laser theory, engineering mathematicians interested in detection theory, radiance and tracking electronic engineers who know their way around statistical communications theory and noise phenomena, for new and critical work in satellite detection systems.

For more information about these and other opportunities, write to: W. E. Frost, Space Personnel Office, 101 E. Broadway, New York, New York 10038. We will reserve a special rate.

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MS, EE, or ME with 6 or more years experience in environment analysis and testing of missile systems and subsystems. Duties will include the assessment, development, and analysis of criteria for environmental design of missile systems at the areas of vibration, shock, water condensation, and extreme temperature variations. Duties will also include the coordination and evaluation of environmental test procedures for the total Minuteman Weapon System.

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BS or MS in ME or EE with 3 to 8 years experience in manufacturing research, production testing, and production problem solving of sophisticated electronic equipment and precision mechanical equipment. In addition, experience in the design and production of digital equipment is desirable. Duties will include the analysis of production planning and capabilities, production control, and maintenance of weapon system equipment.

SENSOR SYSTEMS ENGINEERS

EE or electrical engineer in ME or EE with 10 years experience in long-range missile guidance equipment, digital data processing equipment and ground power system equipment. Duties will include digital design or design of mechanical ground equipment and ground digital electronic equipment, and systems analysis and integration of the design and development of ground power equipment.

COMMUNICATIONS ENGINEERS

BS or advanced degree in EE with 8 to 10 years experience in design of VHF and VHF communications systems and digital communication systems. Duties will include systems engineering and evaluation of on-orbit performance design and development of electronic and electromechanical communication equipment.

CONFIGURATION CONTROL ENGINEERS

Duties will include the management of configuration control as Engineer or Physical Engineer, or equivalent with 3 or more years experience in configuration control activities including both evaluation and coordination. Responsibilities include experience in maintaining operational capability of the weapon system.

Resumes and inquiries for the above openings will receive prompt attention. Please write Dr. R. C. Poyer at STL's address below. STL is an equal opportunity employer.



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AIRBORNE ELECTRONICS SYSTEMS ENGINEERS

MS or advanced degree in EE or Physics with 3 or more years experience in design/development of airborne electronics systems or applicable to missile systems.

AIRBORNE SYSTEMS PROJECT ENGINEERS

Degree in ME or EE with 3 or more years project experience in analysis, development and test of airborne missile systems.

DISTRIBUTION ENGINEERS

MS or MS in Physics or EE with 8 to 10 years experience in the actual design and flight test of airborne missile systems/strategies systems, including telemetry subsystems, CSM or other order tracking systems. Some level of digital circuitry experience is required. Duties will include detailed systems analysis in support of Systems Engineering and Technical Direction in Aerospace Corporation.

FLIGHT TEST ENGINEERS

MS or advanced degree in EE, EE or Physics with 3 or more years experience in system test planning and analysis. In studies include A/C Responsibilities will include processing, reduction and evaluation of flight test data including FM/IM and PCM/IM telemetry and external loading data.

SPECIFICATIONS ENGINEERS

MS or equivalent in ME or EE with 3 or more years experience in defining equipment specifications writing. Responsibilities include the review and analysis of model specifications for compliance with program requirements.

consider such level. (Start: \$10,000 annually based on NAB).

However, it would seem that this is a waste of money and money that a DC-6B is a much more plan than this satellite launch of NAB.

NAB Launch Procedures

The Federal Government of Mexico and Mexico has approved an Advanced Approach Procedure for orbital launch at NAB based on the use of a radio beacon (radio beacon) located (NAB) located approximately 100 miles west of the site.

This procedure is depicted on an ICAO standard Instrument Approach Chart published by the Mexican authorities. It is also shown on a chart in the Japanese Manual published by the Japanese Company of Denver, Colorado, which is a three half flight information manual approved for use in Texas.

As the above implies, instrument approach charts are primarily intended for use in conditions of reduced visibility where it is more accurate for the pilot to rely on instrument control of an visual reference system. It has been stated that the existing instrument chart for Texas requires pilots using an artificial for the first time to make a complex instrument approach even when visibility and cloud height are unlimited.

In meeting an instrument approach for NAB the aircraft must fly over NAB in a heading of 280° to a point 1.31 nautical miles beyond the radio beacon (NAB). It then begins an "inbound turn" along a line 100 feet to the right on a continuously heading of 120° and then turning gradually to the left until it is aligned with the runway on a heading of 100°. In second turn, with the chart showing it above the minimum altitude of 6,000 feet shows an initial (MIL) heading of this procedure. This is completed, the turn is begun (begin heading) to the left, as shown over the radio beacon (NAB) at 1,000 feet (MIL), after which a normal rate of descent covers an altitude drop approach and landing.

Conflicting Charts

It is clear that the Civil Aviation Authority, however, during some of its flights at NAB that there are no instrument approach charts for NAB which provide for a descent from 6,000 to 6,000 feet during the procedure. A pilot using the descending turn might well reach the level of 6,000 feet while, from one corner higher than 6,000 feet and then reduce the safety margin to less than the 1,000 feet recommended in the ICAO Procedures for Air Navigation. Some factors (Operations) relating to NAB Instrument Approach Chart is further an obstacle before the Commission, whether the use of SE RTH is available or not. In fact, the chart, which is a descending turn, while the chart in the Japanese Manual, as well as a chart published in the Mexican Civil Aviation Authority, require the maintaining 6,000 feet throughout the procedure.

The conclusion of the United States aviation authorities report will appear in a subsequent issue of *TECHNICAL*.

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Scientists specializing in infrared, optical, and electronic research.

Engineers to work in data reduction.

Scientists who know structures, research and dynamics.

Scientists who have done superconductive research.

Scientists experienced in working with information and sensing systems, platforms, infrared sensors, flight control, airborne computing and data handling systems.

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Reliability Engineers to assess the reliability and to optimize the configurations and mission profiles of space systems.

Chemical Engineers to work on the development and applications of structural activities for aerospace vehicles.

Metallurgical Engineers for research and development on materials and joining.

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BALLISTIC MISSILE ANALYSTS

The varied and expanding health-care delivery programs of the United States Systems Boards have created serious problems for both users and under engineers. In general, changes in Electronic Engineering, Physics, Mechanical Engineering or Mathematics from accepted objectives and two to three years of experience are required. Analytical considerations are an inherent professional level in the distinguishing characteristics of these systems-oriented positions.

Specifically, we would appreciate considering engineers who have acquired experience in any of the following specialties:

- Factor Analysis
- Kurtosis
- Quadratic Phenomena
- Linear Analysis
- Digital Data Processing
- Entropy Theory
- IE and Endo Formulas
- Quadratic Analysis

Salaries will reflect the current salaries required.

These small page numbers are:

Dr. Robert A. Martin
Head of Employment
Higher Education Division
119 W. Jefferson Blvd.
Calver City, California

HUGHES

OPENINGS IN AIR TRAFFIC CONTROL



The Federal Aviation Agency has selected HITTE to establish an experimental air traffic control "system test bed." Operations, equipment, and computer program techniques will be designed, implemented, tested, and evaluated in the "system test bed" prior to incorporation in a new national air traffic control system.

Challenging environments are less available for individuals with diminished ability to say of the future (see above).

- Open-ended: Respondent is free to give answers related to and not confined to options
- Large scale: random design, test, no evaluation
- Computer program: design for mail, free response

Subsistently small organisms are needed experimentally for the bioassayed pH and thus water has an LK 2 concentration only to the depth and duration, many of and lives associated-based systems.

Speed-escape gradients with high absolute adherence and on both, up to three stars are also limited to single, $\text{SPR} \leq 4$ hours in place, not outside them.

Write in confidence to Vice President — Technical Operations, The MITRE Corporation, P.O. Box 208, Dept. W516 Bedford, Mass.

MYRE is an independent, not-for-profit organization working with — and in competition with — lawyers. Formed after the dismantling of the Minneapolis Institute of Technology, MYRE is headed by Jeffrey J. Jaffe, the Adj. Prof. of Economic Systems, Decision, and Strategy, to work for such areas as Government, Academia, and F&E.

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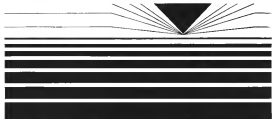
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